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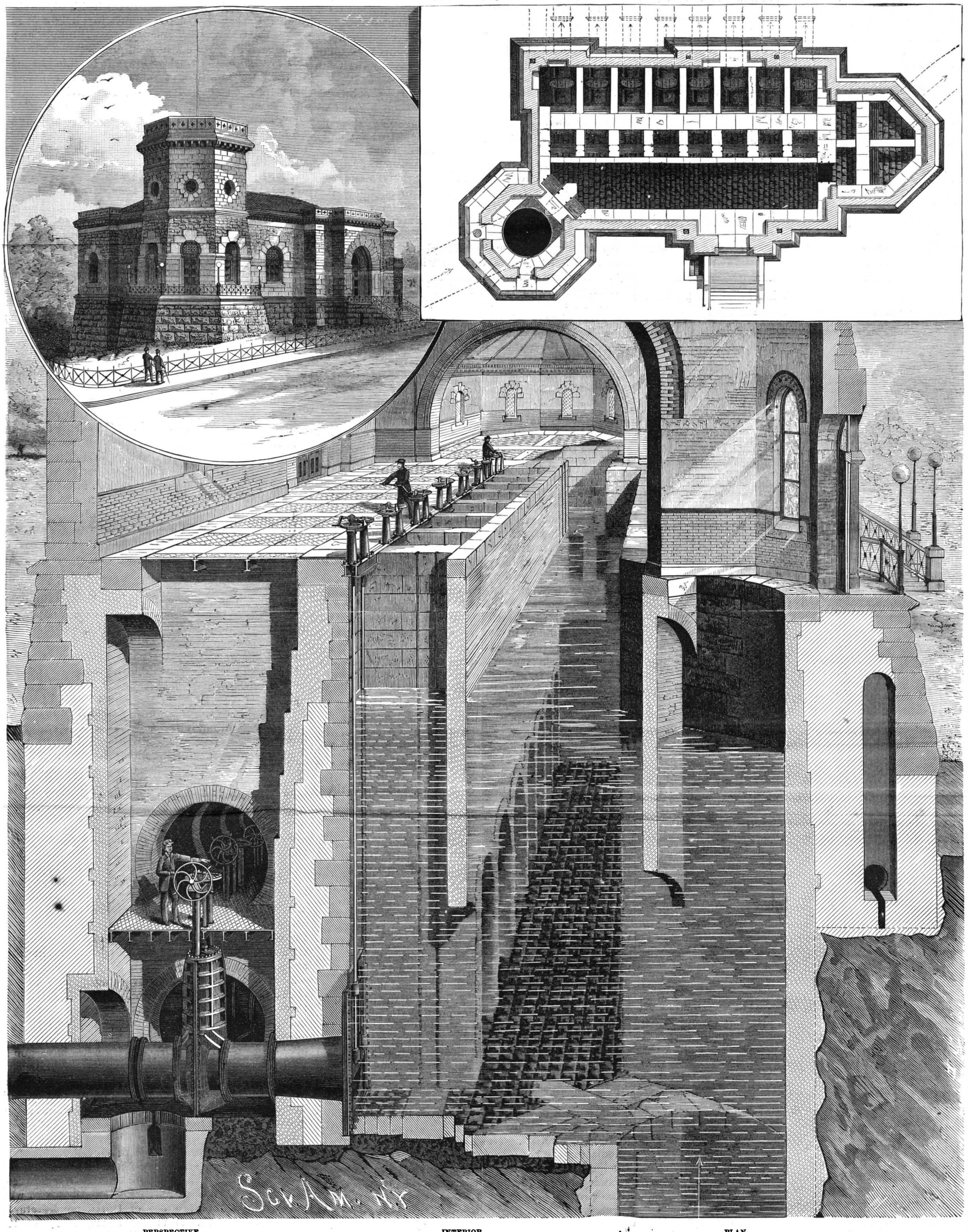


PERSPECTIVE. INTERIOR. PLAN.

**NEW YORK CITY WATER SUPPLY.—PROPOSED GATE HOUSE FOR NEW AQUEDUCT AT 135TH ST. AND CONVENT AVE.**—[See page 326.]

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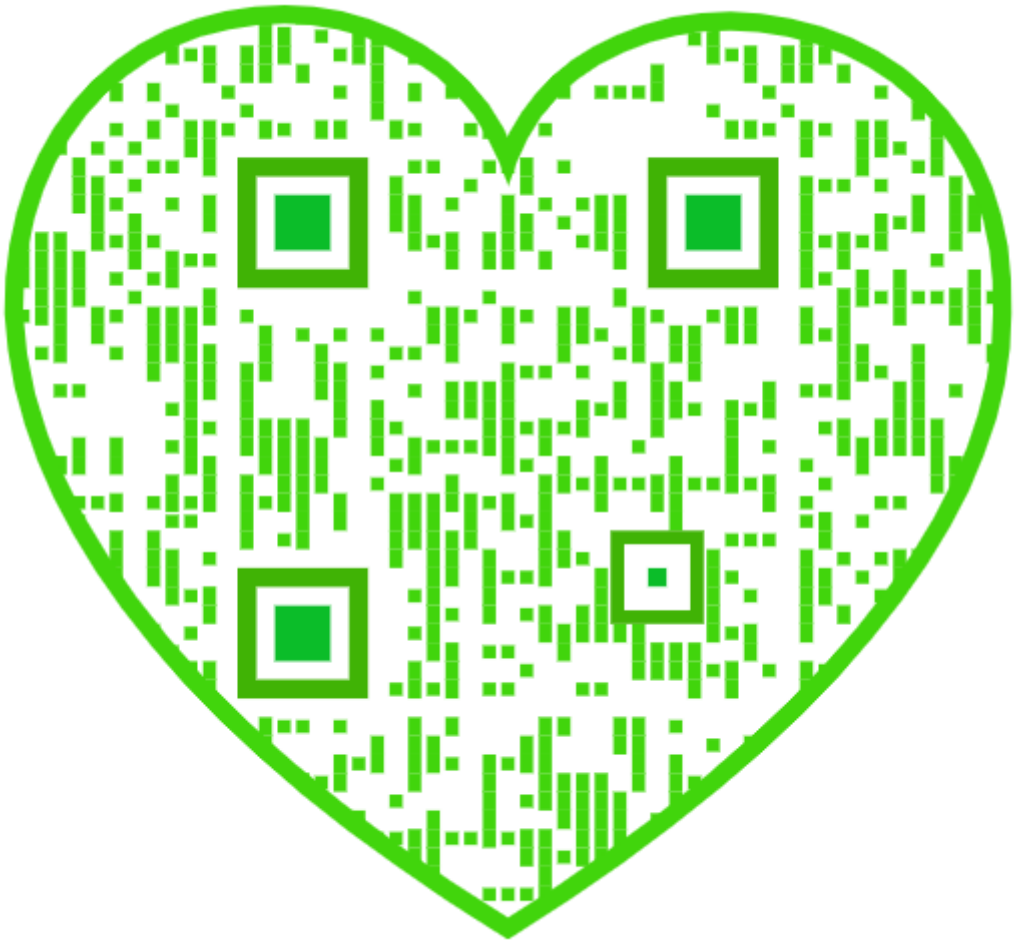

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NEW YORK, SATURDAY, NOVEMBER 20, 1886.


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### THE GOVERNMENT SUIT FOR THE CANCELLATION OF THE BELL TELEPHONE PATENTS.

A suit for the cancellation of the Bell telephone patents was brought by the United States before an Ohio circuit court, in the city of Columbus. Much was hoped for from this action, but it has received one defeat already. The question of jurisdiction by a circuit court over a company not in its district was raised. It was decided that the Bell Company, being a Massachusetts corporation, was outside of the jurisdiction of an Ohio court. Although a stockholder in the Ohio local companies, this was held not to be sufficient connection to establish a partnership. The opinion was a long one, covering 52 pages of type writing. The decision was given without prejudice, leaving it open for the plaintiffs to bring suit elsewhere. The government is just where it started from, with one exception. It can bring a motion in the Supreme Court for a mandamus compelling the hearing of the case by the Ohio tribunal.

The objections to bringing the case in Massachusetts were that, it being the home of the company, a bias favorable to its interests was to be feared. This decision, unless overruled by the higher court, virtually restricts the place of proceeding to the Massachusetts circuits. It is in another sense an unfortunate decision. It virtually tends to establish the fact that a monopoly, as stockholder, can perpetrate injustice in outside States as a stockholder in local companies, while it is protected in its own State by association and business interests.

On January 24 the united telephone suits come before the U. S. Supreme Court on appeal. Burdened by concessions and incomplete as records of the full facts, a great deal is not to be hoped for from these cases. If, as the final outcome, the patent can only have its claims restricted to conform in some sense to the specification, some good will then have been done. At present the patent is held to cover all and every mode of transmitting speech electrically.

### THE STATUE OF LIBERTY, NEW YORK.

Now that Liberty has been dedicated to her task of enlightening the world, there are some timorous minds who fear that something will happen to overthrow her. Where such a mass towers aloft in an exposed position, there are, of course, dangers; but investigation shows that all that human forethought could do probably was done to insure her safety and permanency.

There are five dangers to be feared, namely, earthquake, wind, lightning, galvanic action, and man. If we should have an earthquake of such force as to bring down the goddess, the ruin of New York would be so universal and complete that little thought would be wasted on her disappearance from her pedestal.

Man may some day pull down the statue, just as he has built it up—as the Communists overthrew the Colonne Vendome in Paris. Or a hostile fleet may take it for a target—as the Turks bombarded the Acropolis, in sheer wantonness. But such a fate could not be averted by any mechanical device in connection with the statue's "setting up." It would hardly be practicable, desirable, or artistic to inclose Liberty in shell-proof armor.

The statue's power to withstand the shocks of the wind may be considered as satisfactorily provided for. There are four upright iron posts, which support the whole framework inside. According to the plan designed by Mr. C. C. Schneider, civil engineer, these posts are bolted to six steel girders set upon the pedestal, having four similar girders let into the masonry at right angles to and below them.

Mr. Schneider found the greatest amount of surface exposed to the wind to be 3,475 sq. ft., and the central point of the wind's pressure to be 62 ft. above the base. Then, estimating the greatest wind pressure to be looked for in this latitude at 100 pounds to the square foot—a pressure that would be reached only when the wind was blowing at the rate of 140 miles an hour—the pressure of the wind at the foot would be $3,475 \times 100 \times 62 = 21,545,000$ foot pounds. The centers of the main posts rest upon the girders at a distance, or one side, of 17·38 ft. from the centers of the bearings of the girders in the masonry, and, on the other side, at a distance of 13·78 ft.; consequently, the utmost possible wind strain on the points of support of the statue would be $\frac{21,545,000}{17.38} = 1,239,600$ on one side, and $\frac{21,545,000}{13.78} = 1,563,100$ on the other side.

The weight of the statue was given to Mr. Schneider as 160,000 pounds by one authority, and as 400,000 pounds by another. The greater weight was taken in calculating the bending moment on the girders, while the lighter weight was used in calculating the wind strains, thus producing in each case the greatest strain to be provided against. It was then found that the greatest moment of resistance required in the supports was 2,083, or for each upper girder $\frac{2083}{3} = 694$. Assuming an outside resistance of 20,000 pounds to the square inch for the girders, which were made of ⅝ in. steel, the moment of resistance of each one was found to be 737, or 43 more than required. The steel, moreover, was tested for a breaking pressure of 80,000 pounds to the square inch instead of the 20,000 allowed in the calculation, so that the safety of the girders may be regarded as assured. But there are also backing plates and rods attached to the main posts and girders, greatly increasing the strength, and there is little doubt that before the statue could be overturned by the wind the pressure on its plates would be sufficient to tear them apart.

Against lightning, provision has been made by soldering four ⅝ in. copper rods to the inside of the statue against the external copper plates to a height of 15 ft. above the pedestal. These rods pass through the pedestal, each inside of a 4 in. iron pipe tamped with coke dust, extending 5 ft. below low tide level in the earth. In the lower four feet of these pipes the copper rods are closely coiled like springs, thus giving a greater mass of metal in the wet ground connection. While there are some who insist that the mass of metal in the ground should equal the amount exposed to the lightning, it is probable that in this case the protection is sufficient. The statue itself is the best kind of a conductor as far as her pedestal; hence no outside rods are needed, and the copper rods extending into the ground will doubtless carry off any flashes that Liberty may attract. In any event, no damage would be done to the statue by a stroke of lightning, but only to the pedestal to the extent that the rods were unable to carry off the current.

Against galvanic action, an ingenious insulation of the copper from the iron framework has been employed, the insulating material used being asbestos cloth soaked in shellac; and the device has been managed so cunningly that in no place do the two metals come in contact with each other. It was at first feared that the durability of the statue would be threatened by the great expansion and contraction it would be subjected to under different temperatures, thereby wearing out the copper rivets, or even straining the frame. Experience so far has shown that the mottled or corrugated surface, due to the hammering the copper had received, has prevented much of the expansion that the direct rays of the sun would otherwise have caused. No two contiguous parts received the same amount of heat, and the expansion in midsummer was found to be much less than had been feared. Whether expansion and contraction will eventually produce a serious injury of any kind cannot now be decided; but the indications are not at all alarming.

### EFFECT OF THE USE OF WHITE PAPER UPON THE EYES.

Many believe the eyesight is impaired by the use of white instead of colored, or at least tinted, paper, and at times the subject comes up for discussion. So far as we have seen, no positive evidence has yet been secured to prove the injurious effect of white paper on the eyes, and some recent inquiries lead us to doubt if such evidence is to be had.

A company engaged in the sale of tinted paper recently urged us to say a word against the use of white paper for "billing, letterheads, records," etc., for that it does more to keep the oculist and optician busy than any other cause. Further along they say: "There is no doubt that, in a few years, tinted paper will be used for purpose above named [billing, letterheads, records, etc.], and the white paper now used will be an exception to the rule. In the interests of the clerks and bookkeepers, we appeal to you," etc.

Dr. St. John Roosa, one of the best authorities on the eye hereabout, said, when his attention was called to this: "I have never yet noticed any special ill effects upon the eye from the use of white paper. I have treated many bookkeepers and others who work with the pen, and do not remember to have heard any complaints against white paper, nor any commendations for tinted paper. My investigations show me that a principal injury to the eye comes from improper arrangement of the light when writing."

He says he does not believe that people who use tinted paper for writing are freer from eye troubles than those who use white. As for himself, he has used both, first one and then the other, hoping to be able to note the different effects upon the eyes. None, however, were observed. Dr. Roosa might have gone a step farther, and said that instances could be cited where those accustomed to white paper having suddenly changed, and adopted that with a decided tint, found a mal-influence exerted on the eye, and were compelled to go back to white paper.

It is well known that using the eyes too much or in bad lights will serve to hasten the development of myopia, presbyopia, strabismus, and dantonism where there is hereditary inclination; but there is no record of a case, so say the authorities, where the use of white paper hastened or the use of tinted paper retarded such development. It is not likely, therefore, that tinted paper will replace white in the business transactions of the future.

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### THE NEW NORTH.

Far to the north, amid the streaming splendors of the aurora, the Scandinavian located the blissful realm of the Walhalla. Nor was it alone the dwellers near the home of these lambent lights that felt the glamor of their fascination. The Hebrew poet speaks of the chambers of the north—the city of the great King. Northward points the faithful steel of the magnetic compass; northward hies the hardy explorer, recking not the perils of the toilsome way.

Thus it comes that we already know the Arctic regions far better than we do the Antarctic, although a new interest appears now to be kindling in the latter, and several royal societies in Great Britain, aided by colonial governments of Victoria and other Australian provinces, propose ere long to set on foot expeditions to explore them.

But the expeditions of our day thus far have been to the northward. The story of De Long, Nordenskiold, Ray, Greely, and others need not be here rehearsed. The sad mortality of the expedition commanded by the latter was due, as he himself says, to preventable causes; and his experience has demonstrated that sanitary precautions are practicable which will render life not merely tolerable, but positively enjoyable, in any climate, even the severest yet visited. The difficulty is to insure a sufficiency of supplies where nature does not provide them. This is not always necessarily the coldest nor the most northerly region—as witness the recent famine on the coast of Labrador.

The recent ascent of Mount St. Elias by Lieutenant Schwatka has been sufficiently exploited by the New York *Times*, under the auspices of which the expedition was organized, and a word in passing may be sufficient mention of Gilder's project for taking with him a colony of Eskimo in furtherance of a several years' task of becoming acclimated in a long tug to reach the pole.

Less notice has been taken by the daily press of the expedition of Lieut. Peary to the east coast of Greenland, the prospectus of which was presented to the National Academy of Sciences at Washington last April.

It seems strange, and yet he asserts it to be true, that no determined effort has been made to reach this coast. Two methods are practicable. The one is by landing on the west coast, thence going down to Cape Farewell, and up along the east coast. This might take two years. The other method, which he prefers, is to land at Whale Sound, and cross to the east coast, reaching it about the 80th parallel, a distance of less than 400 statute miles. The natives are friendly and game abundant, the abundance of musk ox and reindeer indicating the existence of fertile lands in the interior. His outfit, as exhibited to the Academy, was one of unusual lightness and strength.

A few years ago, the Hudson's Bay Company sold to the Dominion of Canada the jurisdiction of all its posts scattered throughout the northern part of this continent. A few years ago, the government undertook a systematic series of observations of the climate and navigation of Hudson's Bay and the coast of Labrador, with special reference to the practicability of navigation and the construction of a railroad from Winnipeg to Fort Churchill, affording a much shorter route from the Pacific Ocean to Liverpool than any now used. Since her return from the Greely relief expedition, the steamer Alert has been employed in visiting the stations, to leave supplies and to relieve the men after one year of service at a station. On the 15th of October last, the Alert returned to Charlottestown after her closing voyage in this work, the observing parties having now all been withdrawn. She reports that the channel is generally open only in August and September, as the ice fields come down in September or early in October and close it up. The walrus, whale, and porpoise fishing is recommended as highly profitable. Only two American whalers are now in Hudson's Bay, and they have established a rendezvous at Marble Island, near parallel 63°, in the northwest part of the bay, and on that island several graves and numerous relics were found. Notwithstanding the shortness of the season of navigation, ground was broken for the proposed railroad at Winnipeg the first week of October.

Among the voyagers on the Alert in her trip just mentioned was James McNaughton, whose paper, read before the Albany Institute last spring, gave a graphic account of adventure in and about Hudson's Bay, and was attended by one of the largest audiences ever gathered at an Institute meeting. Among the trophies exhibited was the skin of an immense polar bear with which Mr. McNaughton had a life and death struggle. He was much impressed with the abundance of game and the inexhaustible supply of valuable fish. Whales and walruses abound. Noticing one day a school of 70 or 80 walruses swimming away, he feelingly portrayed his emotion at the sight of $10,000 or $12,000 thus gliding away unhindered. The whole region he pronounces a sportsman's paradise, and predicts that it will become a popular pleasure resort when the southern end of the bay shall be connected with Montreal by rail. Bathing in the bay was not too cold for comfort in August.

The country north of us is not all Arctic, however; far from it. Those who know best, hardly realize how vast is the new domain of arable land which has just been opened by the completion of the Canadian Pacific Railroad, and how much more remains yet to enter. A new north, vast in resources of all kinds, stands ready for occupation. Wheat is raised 1,500 miles beyond the boundary of the United States.

We have seen something of the immensity of the wheat fields tributary to the Northern Pacific Railroad. The statistical report just issued shows an accumulation of over 32,000,000 bushels at terminal points. It seems but yesterday that this vast empire was generally believed to be a frozen waste, and Jay Cooke was ruined by being so far in advance of the people in his knowledge of this region and of its resources, and by investing money in developing it before the public were prepared to follow. Such another region is tapped by the Canadian Pacific Railway. It appears that low prices for wheat have come to stay when the illimitable Northwest and North, by the aid of improved machinery, vie with India and labor at five cents a day. Older wheat fields must, in many cases, be abandoned as unprofitable in comparison.

Nor is it wheat alone that flourishes in the new North. The grandeur of the Canadian forests is probably the one salient feature known to everybody. Lieut. Schwatka, in his book "Along Alaska's Great River," describes the vegetation of the southwest coast of Alaska as rivaling that of the tropics in its luxuriance, forming a tangled jungle, and trees even grow from the tops of the totems of the natives.

The latest discoveries indicate that the greatest surprises may prove to be in regard to the mineral wealth of these northern regions. It was this part of the continent that was first upheaved in the dawn of the archean ages. Gold existed in paying quantities at many places in Alaska. The most stupendous deposit of copper in the world has just been discovered near Sudbury Junction, on the Canadian Pacific Railway, north of Lake Superior. A rough estimate makes the field 4 miles long, 1,500 feet wide, 200 feet deep, mostly sulphuret of copper easily reducible, and containing 50,000,000 tons of metal, which can be laid down in New York as cheap as 4 cents a pound—duty excepted; and, when worked, will necessitate the stoppage of all other mines from the inability to compete in price.

The great work of the year has been the completion, many years before the time contracted for, and the opening to traffic of the Canadian Pacific Railway, over the whole length of which trains began running regularly last July. It was indeed substantially completed last fall, and was operated as far west as Canmore, a distance of 2,329 miles from Montreal. This railroad is now the shortest transcontinental route, and owing to its easy grades and perfect equipment, very fast time is expected to be made by the schedules of next year, this consummation being deferred one year on account of the imprudence of running too rapidly over a new roadbed.

A letter from Mr. Van Horne, vice-president of the road, gives the following information: The region traversed has a climate resembling in the east that of northern and central New York, and in the west that of northern Iowa and Illinois. It is remarkable that during all last winter, while snow blockades interfered so seriously with the Central and Union Pacific railways, the Canadian Pacific was almost entirely unimpeded. This is attributed, not to lack of snow, but to the method of constructing the road, with wide cuts, which enable the wind to sweep through them and keep them clean.

The writer was visiting on Canadian soil, though not at Winnipeg, at the time when the railroad for Hudson's Bay was begun. He was at Toronto, attending the fourteenth annual meeting of the American Public Health Association, the first, however, that was ever held on Canadian soil, and for this reason one of peculiar interest. Among the members was Dr. Russell, health officer of Glasgow, Scotland, who had just returned from a trip across the Canadian Pacific Railway, and reported—having of course examined the country with a professional eye—that he found germ diseases prevailing at settlements along the road, new as they were, and this seems to have been the most characteristic feature of his address to the Association. Perhaps, had another gone over the same ground, his attention would have been directed more to other matters. It should seem, however, that the same thoroughness in sanitation which has redeemed Montreal from smallpox might be equally effective throughout the Dominion, especially as the severe cold of a Canadian winter is generally inimical to bacteria.

Year by year the Canadian and the American people are becoming more nearly united.

The writer found at Toronto, where it was least to have been expected, expressions of a desire for the union of both countries. Canadian sports have come in upon us like a flood of late. It is not a long time since most of us saw, for the first, the Canadian tuque and toboggan. Last winter all Albany was alive with them, and so it will be soon in other Northern cities.

It would be but a tame and unfaithful portrayal of the North that should omit to give a prominent place to the grand and sublime scenery of so many landscapes and waterscapes there. When the prevalence of cholera two years ago in southern Europe turned the tide of travel to the North, Norway ceased to be to many a *terra incognita*, and it was found that even the Alps paled in glory beside the land of the midnight sun. No less is this true of the Arctic scenery of the New World. Indeed, it is almost expected that southern Greenland will become a summer resort. Rev. Dr. Canfield, of Brooklyn, has already announced his intention of making a trip there next summer.

Last winter the artist William Bradford gave a course of readings, illustrated by stereopticon views, of the scenery of Greenland, which vividly depicted its weird and unique sublimity. Mr. Bradford has expended $75,000 in fitting out these expeditions in the interest of art alone.

Probably all other regions of the world must yield the palm to Alaska for grandeur and beauty combined in infinite variety. The sail among the islands of the coast, teeming with vegetation as luxuriant as that of the Amazon, yet alongside of snow-capped mountain peaks and stupendous glaciers, combines the beauty of the inland sea of Japan or of Lake George with the grandeur of the Alps, or indeed of the Himalayas; and had the beauty-loving Greeks of classic ages beheld that far off-hand, there doubtless they would have planted Olympus, the abode of Jove, the lofty thunderer, beside the Norseman's Walhalla and the "city of the great King."

### Tinned Springs—A Curious Experience.

Recently, a Birmingham manufacturer had occasion to endeavor to coat the surface of some hardened and tempered steel springs with tin, a bright and non-corrodible article being required. The springs are C shaped and are about half an inch wide, terminating in two points, by which they are held, and on which they swivel. Large quantities of them had been previously galvanized, and it was found perfectly easy to coat them with zinc, and so regulate the temper in the first instance that the springs retained the necessary temper when finished. When, therefore, the attempt to tin them was first made, it was thought that the temper would be lowered and the spring softened; but the contrary of this was the case. The springs were hardened in oil and then tempered to the proper point, after which the tinning was effected. As soon as the springs were tinned, it was found on testing that they were so brittle that the least pressure caused them to break into fragments. A long series of experiments confirmed this remarkable result, and it was eventually found necessary to pursue an entirely different course. The springs are heated to a white heat and hardened in oil, being then set aside for a day, and allowed to dry. In tempering them, they are allowed to reach a dull red heat, and it is found that, when subsequently tinned, the right temper is obtained. The most remarkable feature in the case is that, unless the springs are hardened and tempered, the tinning has no appreciable effect on the hardness or temper of the steel. It would, therefore, appear that the molecular change effected by hardening and tempering the steel leads up to this remarkable action in tinning. At present the cause is not clear, but some of our readers may be able to throw some light on this matter.—*Industries.*

### Paul Bert.

Paul Bert, noted as an extreme radical in the politics of France, and also as a scientist of some merit, died on November 11. He was born in Auxerre, Oct. 19, 1833. In 1868 he was appointed Professor of Physiology in the Faculty of Sciences of Paris. His scientific researches included many experiments on the factors of existence at different altitudes. Balloons were used to secure the conditions for his experiments. In recognition of his scientific work, he was awarded in August, 1875, the biennial prize of the Institute. In April, 1882, he was elected a member of the Academy of Sciences. During the last ten years he has been much interested in political life, having been Minister of Public Instruction under Gambetta. He received the appointment of Minister of France at Hue, the capital of Anam. He was occupant of this position when he died. His published writings include scientific and political treatises.

JESSE H. LORD, for several years connected with this paper, and favorably known as a writer of ability on machine shop topics, committed suicide on the 10th inst., by shooting himself on the grave of his wife, who died last May.

Mr. Lord was thoroughly at home in the machine shop, and his hints on the proper construction and handling of machinists' tools and the arrangement of machines in the shop made him widely known in mechanical circles. As a writer on mechanical subjects Mr. Lord had few equals, and his loss will be felt by others than those of his friends and aquaintances with whom he came in personal contact. The writer, with many others, laments the death of Jesse H. Lord.

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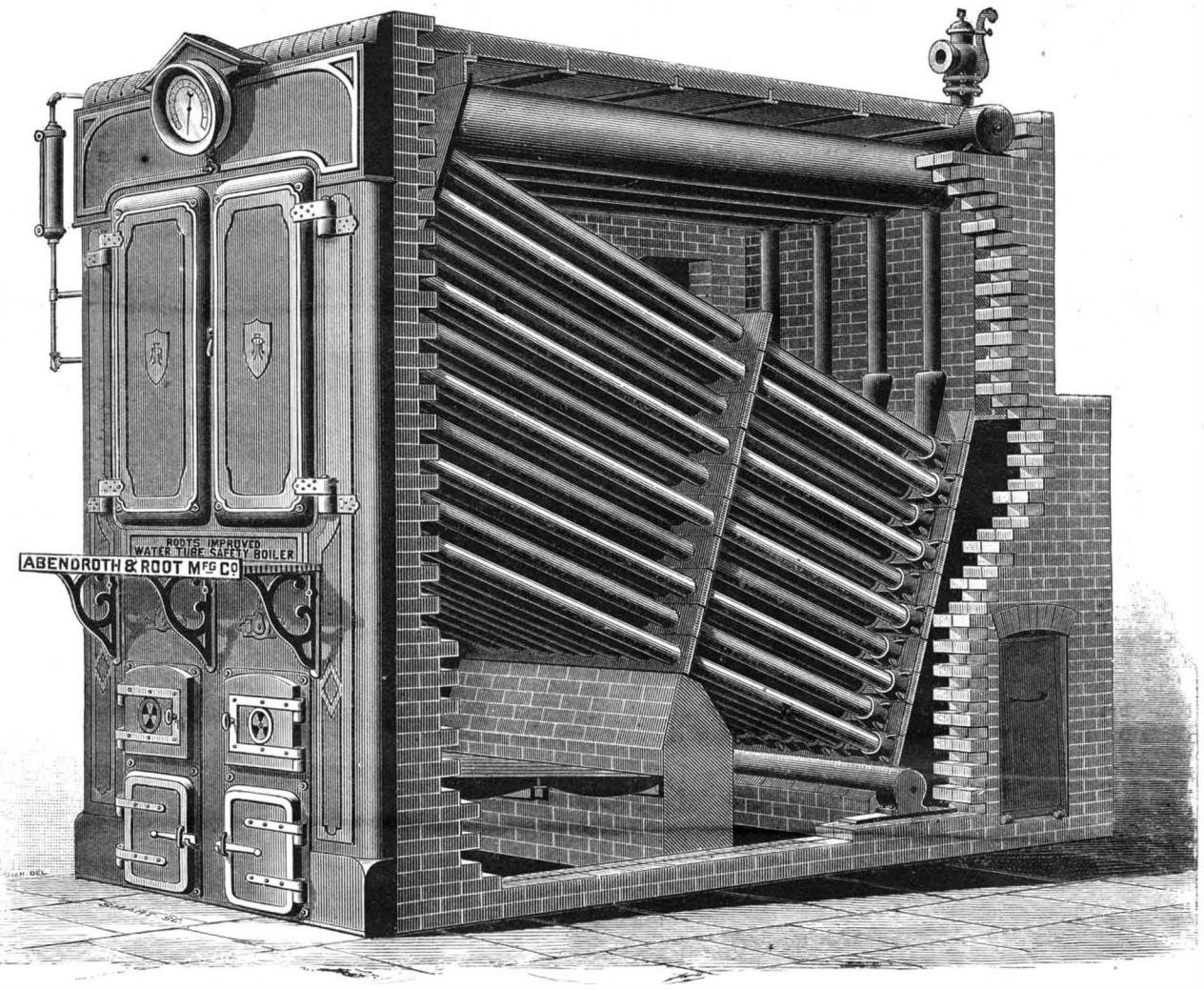
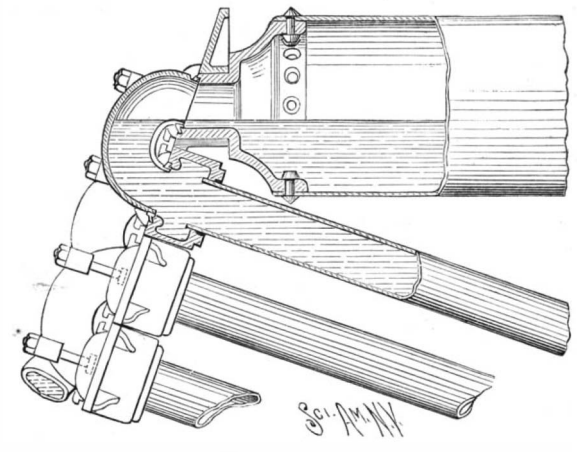
## THE ABENDROTH & ROOT SAFETY BOILER.

The Abendroth & Root safety boiler is illustrated in the cuts accompanying this article. It is of interest as being a successful safety boiler. It not only is non-explosive, but the same peculiarities which make it so also conduce to economy of working, on account of the subdivision of the water into small masses, freedom of circulation, and large heating surface. Cheapness of construction and facility of repair follow from the use of straight tubing only in its construction.

The boiler proper is inclosed in a fire chamber over a grate. This chamber is conveniently made of brick, with iron front and cleaning doors. A rack of small tubes, four inches in diameter, is supported in an inclined position, and constitutes the steam generating portion. The tubes are connected continuously throughout by return bends, held in place by bolts and nuts. Feed water enters at the lower and rearward




THE ABENDROTH & ROOT SAFETY BOILER.



END TUBE CONNECTIONS.

end of the boiler into a transverse pipe, connecting with the tubes, that acts as mud drum for the collection of any sediment that may form. The upper and forward end of the rack of tubes connects with larger horizontal pipes. These run back through the upper part of the fire chamber, and at the rear have two connections. One is with the rear of the tubes by means of several up-takes, one for each horizontal pipe. The other is with a horizontal transverse pipe, which acts as steam dome. To it the steam pipe is connected.

The steam connections for both steam gauges and water column are taken from the front end of one of the large pipes. The water connection for the water column is taken from one of the down-takes at the rear of the boiler.

These connections, and also that for feed water and steam, are shown in the longitudinal view, partly in dotted lines.

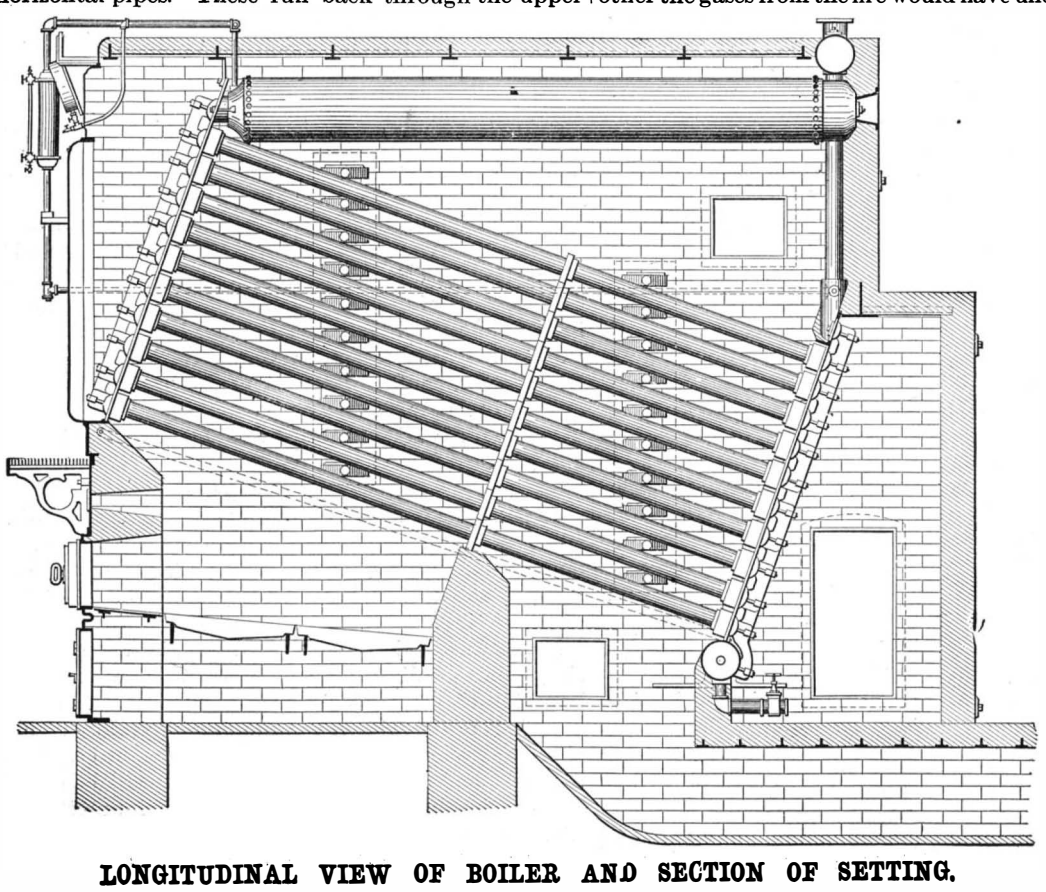
The position of the different doors is clearly shown, and illustrates the ease of access for purposes of cleaning. Independent of the convex shape of the heating surface, that cannot retain flue dust, the accessibility of all parts makes the cleaning a simple matter. The methods of support at front and rear are cast-iron beams with intermediate bridge wall blocks, for disseminating the heat, which can be seen in the same view.

The tubes are arranged alternately, as shown in the rear elevation and in the small cut of details. This favors a more thorough mixing of the products of combustion and absorption of heat. Were the series of tubes arranged vertically above each other the gases from the fire would have unobstructed channels through which to pass. As it is, in the actual construction, the currents are continually broken up by meeting new tubes, so that their heat is most effectually taken from them.

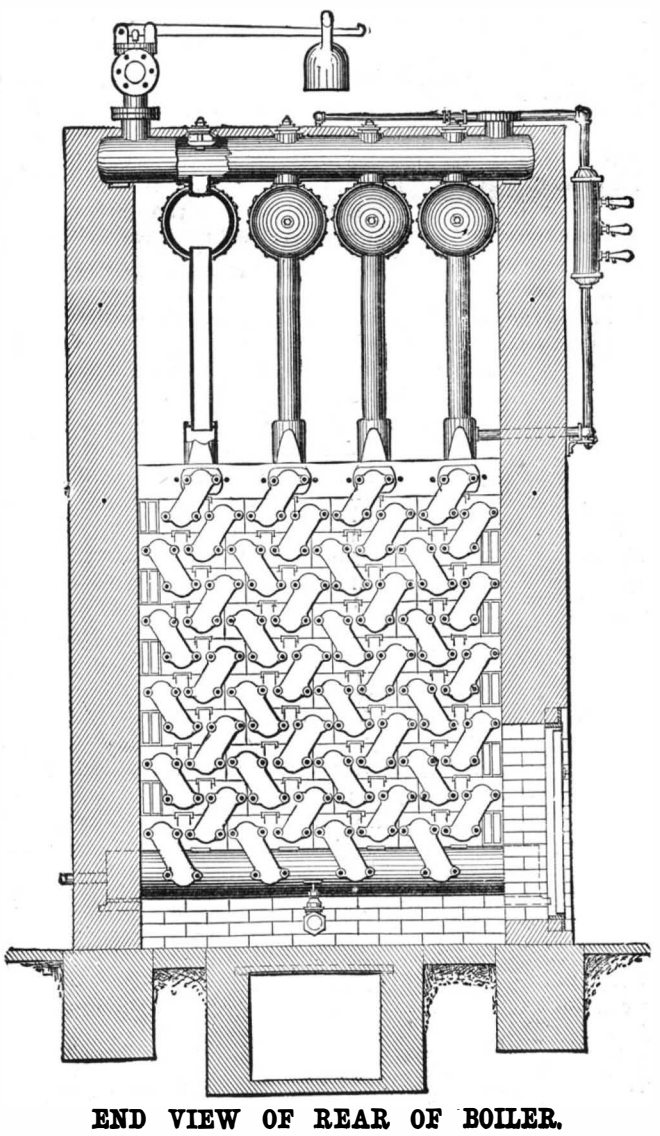
The claims to safety in this boiler rest on the strength of tubes and on the fact that under heavy pressure they do not tend to actually explode. Little more than a rupture can happen. Even if a tube exploded it could do no harm to life or property, the accident would be so local and slight in amount.

The facility of repairs is also to be noticed. To replace a tube after the fire is drawn and the boiler is empty, all that is necessary is to remove two return bends at the rear and two corresponding ones at the front, when the injured tube with its companion can be pushed out of the front door. Then a new pipe can be inserted, the whole being the operation of only a few minutes. Even drawing of the fire is not absolutely necessary for this operation. Its heat can be reduced sufficiently by banking. As all the work is done from the outside, the gases from the banked fire will do no injury to the workmen. Thus almost all necessity for specially skilled labor is avoided. The repairs are a matter to be executed by a machinist. The boiler maker is never required. The relative sizes of pipes are illustrated in the cuts. The boiler there shown is supposed to have four inch pipes in its rack, with fourteen inch horizontal pipes. These boilers are used in some instances under a steam pressure of 250 lb. to the square inch, thus demonstrating their absolute safety, and are giving most satisfactory results. They are also in extensive use in this and all other countries.

Manufactured and supplied by the Abendroth & Root Manufacturing Co., No. 28 Cliff St., New York.



LONGITUDINAL VIEW OF BOILER AND SECTION OF SETTING.



END VIEW OF REAR OF BOILER.

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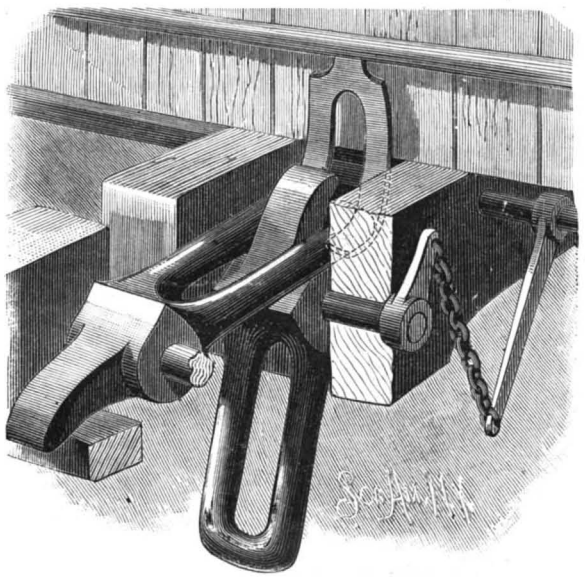
### CAR COUPLING.

The accompanying engraving represents a car coupling which has been patented by Mr. A. H. Boies, of Hudson, Mich. In a central vertical slot in the drawhead is a combined coupling hook and link rigidly connected to a shaft passing through the drawhead.. To the shaft are secured arms, connected by chains with arms on a shaft mounted in proper bearings secured to the under side of the car. By turning this shaft in the

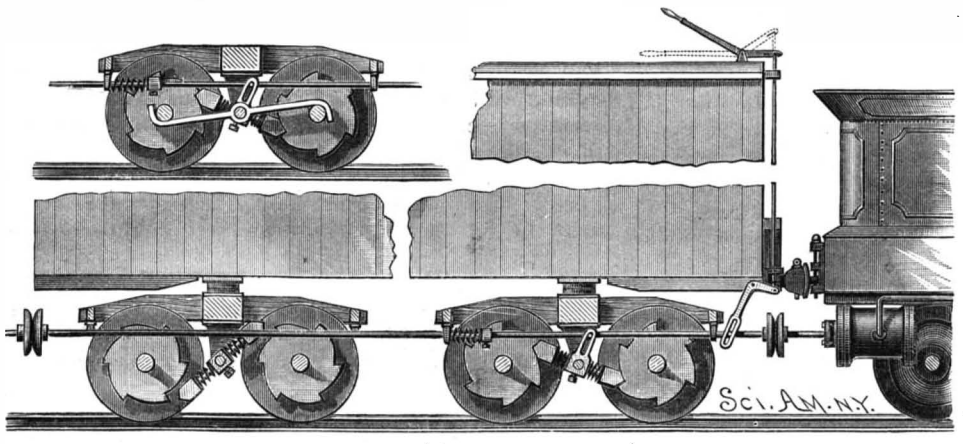


BOIES' CAR COUPLING.

proper direction, by means of crank handles at either end, the links may be elevated. A second shaft is mounted in bearings in the end of the car, and is provided with a forked arm whose fingers press, when thrown upward, upon each side of the hook. To operate this coupling, one of the links is allowed to assume a vertical position, with its link portion resting against a stop extending across the lower part of the slot in the drawhead. The link of the approaching car is elevated so that its link will drop over the hook of the other coupling. To uncouple the cars, the upper shaft is turned so as to throw the fingers of the fork forward and upward, so that they will raise the link from the hook. It will be seen that the cars may be coupled and uncoupled without entering between them.

### CAR BRAKE.

This brake is designed for use in connection with passenger cars as an auxiliary brake, adapted to stop




MORROW'S CAR BRAKE.

the train suddenly when necessary. When used in connection with freight cars, it serves all the purposes of an ordinary brake, and yet is capable of instant application, to thoroughly brake the train when moving at a high rate of speed. Fastened to the axles of the car near the inner face of each wheel is a second wheel, formed with a toothed periphery, as shown in the engraving. These wheels are so placed that the vertical faces of the teeth of the wheels on one truck will face in a direction the reverse of the vertical faces of the wheels upon the other truck. Between the axles of each truck is mounted a shaft, carrying blocks formed with oppositely extending arms, held in line with the toothed wheels. These arms are encircled by springs bearing against angular faced brake shoes, adapted to slide a limited distance upon the arms. The springs relieve the shoes and arms from the sudden shock brought to bear upon them when the simultaneous engagement of the shoes at each end of the brake is made with the teeth of the wheels between which the brake is centered. Each set of brakes operates independently, that is, the brakes on the forward truck are operated while those upon the rear one are idle, and *vice versa*. Supported at each side beneath the car, and between the car wheels and toothed wheels, is a rod. The ends of these brake rods project beyond the ends of the car, and are provided with buffers. The rods are provided with springs and are suitably connected with the brake blocks, so that the shoes are normally held out of engagement with the toothed wheels. The rods are adapted to be operated upon by a piston in a steam cylinder placed under the tender of the engine, the ends of the piston rods being furnished with buffers similar to those on the brake rods. The return stroke of the piston is made by a spring, which thus obviates the necessity of introducing steam at both ends of the cylinder. When steam is admitted to the cylinder, the piston rod is forced out, and the brake rod upon the first car is moved. This in turn communicates the motion to the next car, and so on throughout the train. This rearward movement of one of the rods causes the shoes on the forward trucks to engage with the toothed wheels, and thereby almost instantly stop the train. The consequent shock is somewhat relieved by the wheels of the rear trucks, which are left free to revolve. By means of simple connections the brake can be operated from either the top or platform of a car. Provision is made for preventing the bending of the axles under the strain brought upon them.

This invention has been patented by Mr. John Morrow, whose address is P. O. Box 88, Philadelphia, Pa.

### One Hundred Years.

At the recent celebration of the hundredth birthday of M. Chevreul, the distinguished French chemist, he was presented with a copy of the number of the *Gazette Royale* published on the day he was born, in September, 1786. Commenting on the contrast of "then and now," the Paris *Figaro* reminds its readers that to realize the width of the gulf which is spanned by the life of this single man, they must remember that on the day of M. Chevreul's birth Marat was veterinary surgeon to the royal mews at Versailles, Danton and Robespierre were obscure provincial lawyers, Murat was preparing to enter a religious order, Ney was eking out a scanty existence as a copyist, and Bonaparte had just received his commission as second lieutenant of bombardiers of Autun, in the Regiment de la Fere. Frederick the Great of Prussia had died only a few days before Chevreul was born, Joseph II. was Emperor of Germany, Catherine II. Empress of Russia, Gustavus III. King of Sweden. The bare enumeration of these names tells how completely France and Europe have been transformed. During his century of life M. Chevreul has seen three Kings of France, one King of the French, two Emperors, three Republics, 65 Marshals, 66 Ministers of Justice, 75 Ministers of Marine, 84 Ministers of War, and 92 Ministers of the Interior—or one for about every 13 months of his life.

### APPARATUS FOR CLOSING APERTURES IN THE HULLS OF VESSELS.

The invention here illustrated is intended to provide practical means whereby a breach in a vessel's hull, from a collision or other cause, may be effectually closed from either the inside or outside of the vessel. For closing the opening from the outside a frame made of any appropriate size and weighted to sink in the water is used. To the edges of one side of the plate are secured wooden strips, attached to which are cushions of rubber or other suitable material. The frame is lowered over the apertures from the deck by ropes secured to eyes in one edge. The pressure of the water causes the plate to hug the hull, so that it will prevent all, or nearly all, the inflow of water to the vessel, the cushions forming water tight joints between the hull and frame. The inner surface of the plate is provided with several bolts, to which ropes may be attached, in order to secure the plate in place from the inside of the vessel.

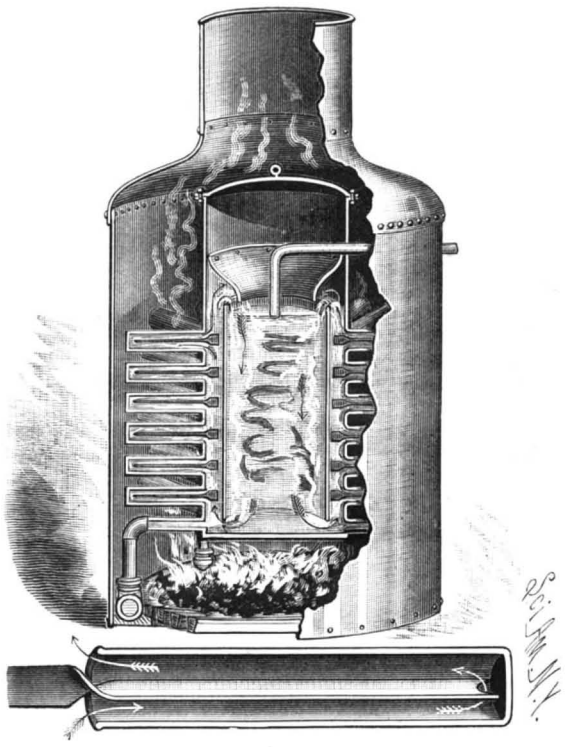
In Figs. 2 and 3 the frame is applied from the inside to close an opening in the bottom of the vessel, while in Fig. 4 a side opening is closed from the inside. In these cases a brace bar is arranged to be held across the opening in such a way that a screw passing through its center can be forced against the plate placed over the aperture.

This invention has been patented by Mr. John Speirs, of 92 Zabriskie St., Jersey City, N. J.

To produce a good gloss on linen, pour a pint of boiling water upon two ounces of gum arabic; cover it, and let it stand over night. A teaspoonful of this is added to the starch.

### STEAM GENERATOR.

Placed centrally within the boiler shell is a closed cylinder, provided with horizontal tubes placed radially. In each of these tubes is placed a horizontal partition having a curved outer end which establishes communication between the upper and lower chambers. The inner end of each partition projects beyond its tube and is twisted at right angles (as represented in the lower figure), and extended close to an annular partition which is placed inside of the cylinder, and is open at the top and bottom. A short distance above the upper edge of this partition is placed a curved annular flange, secured to the inside of the cylinder. The cylinder is supported by pipes opening into the cylinder, and which connect at their lower ends with a circular pipe placed around the grate bars between the latter and the shell. The sup-



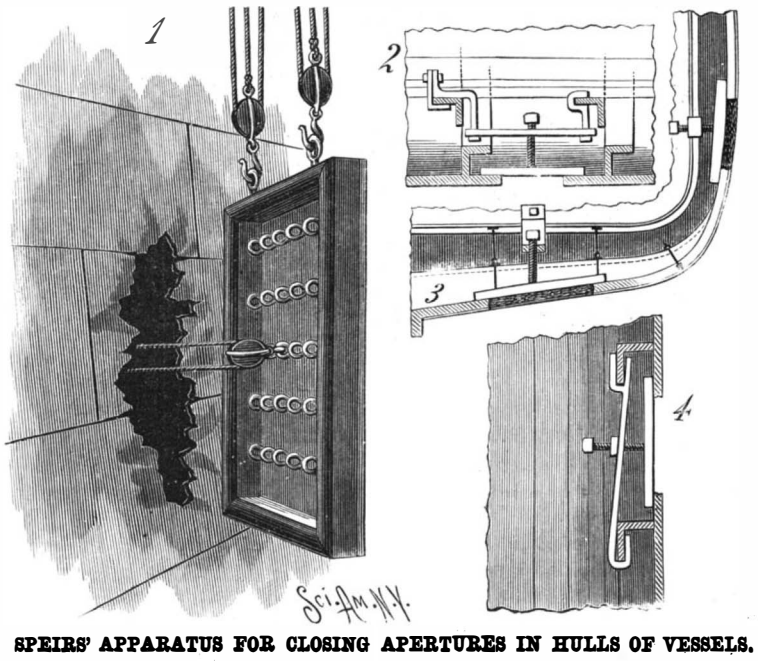
STUTSMAN & COLE'S STEAM GENERATOR.

ply pipe opens into the annular partition a short distance below its top. The cylinder is provided with the usual steam outlet pipe, safety valves, etc., and the shell has the usual smoke stack, doors, etc.

The cold water enters the annular partition, descends toward the bottom, and is heated by the fire; it then passes into the space between the partition and cylinder. From there it rises either directly upward or into the lower chambers of the lower tubes, passes to the outer ends and then back through the upper chambers; then through the upper tubes, until it reaches the edge of the annular partition, over which it flows. The curved flange prevents the water from splashing against the dome of the cylinder and directs the flow of water from the outside to the inside of the partition. The water is rapidly heated in its passage through the tubes, and the sediment flows from the cylinder into the tubes, and finally settles in the circular pipe at the bottom.

This invention has been patented by Mr. Henry Stutsman and David Cole. Particulars can be had by addressing the latter at Portland, Oregon.

THE *Age of Steel* understands that $80,000 has been offered for a patent just issued to a Pittsburg gentleman for a rod rolling mill. The mechanism is simple, and combines both the drawing and rolling processes, accomplishing the work in a rapid and most satisfactory manner.




SPEIRS' APPARATUS FOR CLOSING APERTURES IN HULLS OF VESSELS.

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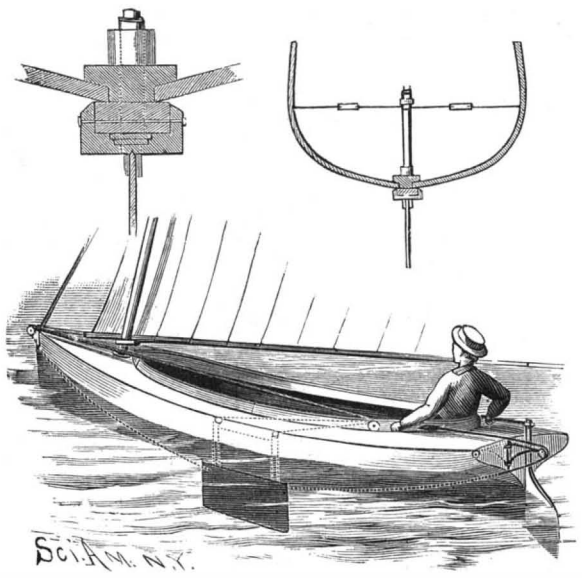
### CENTERBOARD FOR VESSELS.

The centerboard here illustrated is so arranged that it may be almost instantly set and removed as the sailing conditions and emergencies may require, the operations being performed by the helmsman at the stern of the vessel. Where the centerboard is inserted the keel is made in two parts, as shown in the enlarged sectional view, between which the side planks of the hull are held. To the lower part is fixed a metal shoe having a longitudinal ranging slot, in which fits the upper edge of the centerboard. Hollow metal plugs having fixed collars at their lower ends are passed upward through the keel, and are screwthreaded at their upper ends to receive screw collars, which, when screwed



McFALL'S CENTERBOARD FOR VESSELS.

home, draw the shoulders tightly to the bottom of the keel and clamp the two parts together, the joints being all water tight. The screw collars project above the plugs to receive the ends of tubes, which are only long enough to substantially support rods whose lower ends are screwed into thimbles fixed to the upper edge of the centerboard. These thimbles have shoulders that fit tightly to the lower ends of the plugs when the centerboard is in place. To the tops of the rods are attached ropes or chains, which are guided over blocks to within easy reach of the helmsman. The tubes are firmly braced by stay rods fixed to their tops and to the sides of the vessel.

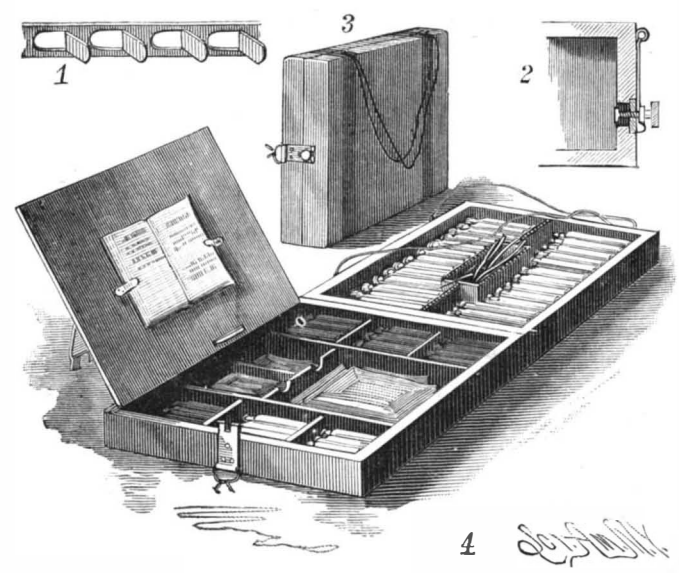
Should the helmsman wish the vessel to drift or make leeway, he will unfasten the chains and let the centerboard fall away some little distance from the keel, and thus become inoperative. By drawing upon the chains, the centerboard may be again brought into use.

Should the centerboard be run hard aground, the rods will be unscrewed from the thimbles, when the boat will be free. If the centerboard is lost, a new one can be easily set by pulling chains attached to the rods of the new one through the tubes, by means of lines. If at any time the centerboard is not needed, the chains are slacked off, and it is pulled on board by chains arranged to pass over either the stem or stern.

This invention has been patented by Mr. David McFall, 213 East 35th Street, New York city.

### A MEDICINE CHEST WITH MANY CONVENIENCES.

The illustrations herewith represent a peculiarly partitioned and constructed medicine chest, of a




HUTTON'S MEDICINE CHEST.

flat shape, which has recently been patented by Mr. Terry J. Hutton, of Fergus Falls, Minn. Fig. 1 is a perspective view of a piece of a struck-up metal strip for holding the lower ends of the vials in position, and Fig. 2 is a vertical section of the front end part of the chest when closed, illustrating the fastening, Figs. 3 and 4 showing the chest closed and open respectively.

The chest forms a case composed of upper and lower main sections hinged together at one end, the lower section being principally divided into two longitudinal vial-holding compartments, one above the other, with a central compartment which can be used to hold a drop measure, surgical needle, brushes, etc. The vial-holding sections are arranged to hold vials of different sizes, the vials being securely held in pockets, but so that the labels indicating their contents can be easily read. The upper section of the chest is divided by transverse partitions and a longitudinal partition, to give compartments for holding plasters, bandage strips, etc.; but the partitions are shallow, to allow room for a handbook of directions attached to a cover which fits over this compartment. The lock used is a simple one for the purpose, so the chest may be easily closed or opened, and always carries its own key. When the chest is fully thrown open, and the lid set inclining in its open position, all the contents are exposed to view, and there is no necessity to remove some of them to get at the others. The inventor has likewise obtained a copyright on an appropriate trademark for this chest.

### Erosion of Gun Barrels by Powder Products.

At a recent meeting of the Iron and Steel Institute, a paper on this subject was read by Sir Frederick Abel, and Colonel Maitland, superintendent of the Royal Gun Factories, Woolwich. The peculiar action of powder products upon the inner surface or bore of a gun, as they rush from the seat of the charge toward the muzzle, whereby more or less irregular scoring or erosion is produced, is ascribable to the co-operation of three causes, viz., a softening if not a fusing effect, exerted upon the surfaces of the metal by the high heat of the explosion; an increase of this softening or fusing effect by the chemical action of the sulphur upon the metal at the high temperature to which the surface of the latter is very rapidly raised; and the mechanical action of the rush of gases, vapors, and liquid products upon the softened or fused surfaces. The great increase which has been taking place during the last twenty years in the power of artillery has brought the subject of the erosion of gun barrels into prominence, and it is not too much to say that it now forms one of the chief difficulties to be encountered by the maker of a heavy gun. As far as can be seen at present, its sufficient mitigation is the one great difficulty which seems likely to impose a limit on the size and power of ordnance in the future. Erosion is of two kinds, technically known as muzzle loading scoring and breech loading scoring, though both kinds occur to some extent in all guns, whether muzzle loading or breech loading. Muzzle loading scoring is produced by the rush of the powder products over the top of the projectile through the clearance, or windage, which has to be allowed for facility of ramming home the shot along the bore in a muzzle loader. Breech loading scoring is produced by the rush of the powder products behind a shot, acting as a gas-tight plug, during and immediately after its passage through the gun.

Muzzle loading scoring takes place almost entirely in the upper surface of the bore, and its effect diminishes greatly as the velocity of the advancing projectile increases. Breech loading scoring, on the other hand, erodes the bore almost equally all round, and extends toward the muzzle, till the pressure of the expanded gas is so much reduced as to render it ineffective.

It is evident that, *cæt. par.*, erosion will increase with the amount of the powder products, with pressure in the bore, and with the duration of the time of action. Its inconvenience first began to be seriously felt in the 7 inch muzzle loading gun of 7 tons weight, which fired a charge of 30 pounds of powder with a shell of 115 pounds. The great strides which have since been made in the weight of projectile and the amount of powder charge fired from heavy guns have resulted in increased rapidity of the deterioration of guns from this cause; and now that it is proposed to arm the Benbow with 16¼ inch breech loading guns of 110 tons weight, which will fire a shell of 1,800 pounds weight with a charge of 900 pounds of powder, the question of erosion becomes one of paramount importance. The 7 inch gun above mentioned was able to fire about 600 full charges before the bore had become so badly scored as to require its interior to be fitted with a new tube; this number of rounds was increased to about 1,900 by the introduction of an expanding copper gas check, fitted on the base of the projectile. The adoption of breech loading further increased the life of the gun by sealing the muzzle loading scoring still more effectually; but on the other hand, it permitted the use of greatly increased charges of slow burning powder; and the extensive erosion now speedily produced in some of the heavier breech loading guns renders it probable that the interior surface of the 110 ton gun will require renewal after only a brief existence. Under these circumstances, it becomes of very great importance to ascertain what material best resists erosion by powder products, or, what treatment of the material is best calculated to increase its powers of resistance to erosion.

### UMBRELLA SUPPORT.

By means of this simple device, an umbrella may be attached to the side of a wagon, boat, baby carriage, etc., and held in any desired position. A clamp attached to the side of the boat is arranged to receive a tube held in position by a set screw. This tube may be placed in either of two sets of holes in the clamp, to hold it in a

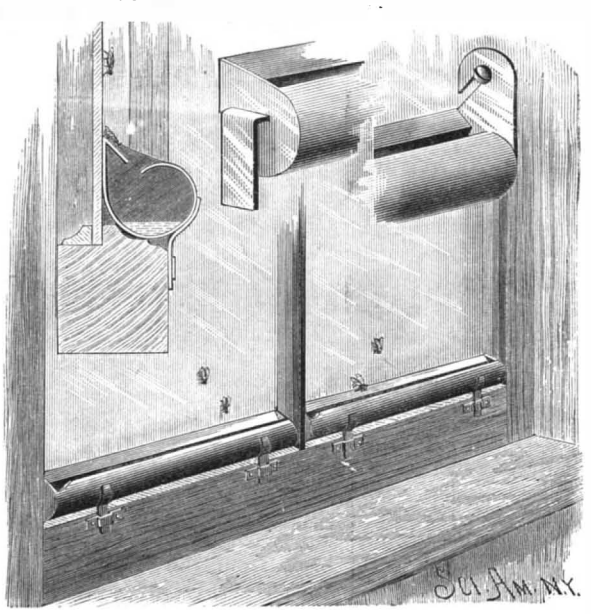
TOSSO'S UMBRELLA SUPPORT.

horizontal or vertical position. Near the upper end of the tube is a set screw, that holds a rod formed at its upper end with a right-angled arm provided with a disk serrated on one side. To this disk is clamped a similar one on an arm whose free extremity is concaved to fit the umbrella handle, which is retained therein by a clamp provided with a screw that presses against the back of the arm and secures the handle. It will be seen that the construction allows the placing of the umbrella in any suitable position for shielding the user from sun or rain.

This invention has been patented by Mr. Hippolyte Tosso, of 227 and 229 Decatur St., New Orleans, La.

### FLY CATCHER.

The accompanying engraving represents a simple device for catching flies, which has been recently patented by Mr. Z. F. Xevers, of 208 Brannan Street, San Francisco, California. An approximately semi-cylindrical trough is provided with tongues, which are received in clips secured to the lower rail of the window sash, as shown in the large view in the annexed engraving. That side of the trough touching the glass is made plain, to fit closely against the glass, so that the flies on the window can readily gain access to the trough. Near the upper edge of this side is secured a strip, arranged so as to form a barrier, preventing the return of the flies to the glass. The trough is partly filled with a suitable fly-killing liquid. The left hand upper view is a cross section through the



XEVERS' FLY CATCHER.

lower one. The other two views represent different methods of holding the trough to the sash.

THE Great Eastern steamship has been converted into a show vessel, and for the first time since her construction is making money for her owners. The ship, which for several months has been on exhibition at Liverpool, has lately gone to Dublin, where she will stay for the winter. Only her screw propeller is now used.

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### Improvements in Making Sugar.

The following has been received at the Department of Agriculture:

FORT SCOTT, KAN., November 8, 1886.

*To the Commissioner of Agriculture:*

We finished boiling 83 tons of Louisiana cane to-night. Made nearly 19,000 pounds of strike. A weighed portion run into centrifugal gave 54 per cent of dried sugar. This will be more than 120 pounds first sugar per ton. Cane sugar had 10 per cent of sucrose, 1·8 per cent of glucose, and 14½ per cent of total solids. It would have made only 80 pounds by the old process. We have increased the yield fully 40 pounds per ton, sugar of fine quality.

WILEY, *Chemist.*

This dispatch is regarded by the authorities at the Agricultural Department as the fulfillment of the promises of important results given by the first incomplete experiments in the diffusion process as applied to sugar cane. The process was developed in Europe for application in the manufacture of beet sugar, and has been several times tried in this country upon the sugar cane, but without decided success, owing to imperfect machinery and the necessity of considerable modifications to meet the difference in the material to be worked. In 1883, experiments in the new process were begun on a small scale in Washington upon sorghum, and after a time such a measure of success was attained that the Commissioner determined to put the process into operation upon a larger scale. To this end, a plant was established in connection with a sorghum sugar making establishment at Ottawa, Kansas, and this season the new process has been carried on under the supervision of Professor Wiley with marked success. Meanwhile the sugar cane growers of Louisiana have become deeply interested in the process, and have anxiously desired to learn whether it could be made applicable to their products. To test the matter, the Commissioner has decided to undertake the experiment in Louisiana upon a scale of sufficient magnitude to determine its practicability, but as a preliminary test he caused a train load of sugar cane to be shipped from Louisiana to be worked up in the Kansas sorghum mills. It is the result of this experiment which Professor Wiley announces in his telegram.

The diffusion process above referred to has long been operated in Europe, but from some unexplained cause our sugar makers have been backward in giving it a trial. One writer finds a reason in the idea that sugar cane men here have more money than brains.

The diffusion process for making sugar is very simple. It consists, in brief, in chopping up the cane into small bits, say slices an eighth of an inch thick, then steeping the mass in tubs for two or three hours with hot water. This extracts the saccharine matter much more effectively than the ordinary mode of squeezing the cane between rollers. The warm juice thus obtained is then heated and stirred with the addition of lime, and finally brought to a boil; it is then allowed to stand a while and the clear part is then run into the vacuum pans and boiled into sugar, in the usual manner. The refuse from the tubs may be fed to cattle. Any intelligent farmer may work the process. The cost of apparatus is small. A full account of the mode of working this process will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 532.

### The National Academy of Sciences.

The fall session of this society met on November 9, at the Massachusetts Institute of Technology, Boston. Dr. Othniel Charles Marsh, its president, in the chair. Professor S. P. Langley read a paper on "The Solar-Lunar Spectrum." It detailed the last results of his experiments on heat waves in the invisible spectrum, and dealt with his discovery of the lowest form of them in the radiations of the sun—radiations formerly detected only in the moon's emanations. Formerly the moon's radiations were supposed to extend further down the spectrum than the sun's. He concluded that the temperature of the moon when illuminated was about equal to that of melting ice. Professors Lyon Fairchild and Alfred Russel Wallace, of England, were at this point invited to participate in the proceedings. Professor T. Sterry Hunt read a paper on "A Basis for Chemistry." It is impossible to give any abstract of it here. It is of special interest, because in his remarks he promised a book on the subject under the same title. The general tendency was to extend the domain of chemistry into the physical field. Professor Edward D. Cope read papers on "Human Dentition" and on the "Auricular Anatomy of Tailed Batrachians," and on the same day Professors Morse and Packard spoke on palæontological subjects, the first on "Change in Mya since the Pliocene," the other on "Cave Fauna of North America." On the second day's session, Professor Alpheus Hyatt spoke on the "Primitive Forms of Cephalopoda," giving a history more especially of Ammonites. This he followed by two other geological papers. Professors Peters of Hamilton College, O. T. Sherman of Yale, and W. S. Elkin of Yale contributed astronomical papers. On the third day, Professor Wallace, by invitation, addressed the meeting. His subject was "The Wind as a Seed Carrier in Relation to One of the Difficult: Problems in Geographical Distribution." The title indicates clearly the scope of the paper, Dr. Wallace is well known as one who has given special attention to the distribution of life and plants on islands. His well known studies in the Malay Archipelago naturally took this direction. The general claim was made that wind could transport seeds from much greater distances than was usually believed possible. Professor Edward C. Pickering then spoke on the "Draper Memorial Photographs," which include the photographic investigation of star spectra, principally at the expense of Mrs. Henry Draper. Professor F. W. Putnam spoke on "Archæological Explorations in the Little Miami Valley, Ohio," and was followed by Professors Charles A. Young, Raphael Pumpelly, Cleveland Abbey, and T. Sterry Hunt with papers on special subjects.

The meeting adjourned to meet at Washington, D. C., on the third Monday of April, 1887.

Among those present, and not named above, were Professors C. F. Chandler, Wolcott Gibbs, H. A. Newton, Henry A. Rowland, and Francis A. Walker.

### Manufacture of Small Arms in Belgium.

In general, piece work is the system adopted, and the earnings of the men range from 50 cents to $1 per day, working from ten to twelve hours a day. The following is given by the United States Consul (Mr. G. D. Robertson) as to the details of the cost of a double barreled breech loader, costing $20 or 4*l.*:

"For the barrels is paid about 7s. or $1.75. The barrels received by the manufacturer are at once given to the 'garniseur.' He is instructed in regard to the length, height of band, and for what kind of breech action they are intended. It is also his duty to take the barrels to the proof house, where they are proved before and after being put together. If imperfections are discovered, the barrels are returned to the barrel maker to be rewelded or replaced. Putting together, proof, portage, etc., costs about 4s. The barrels having been returned, the proof marks are inspected, and the band which holds them together tested as to its firmness and strength. The piece which is intended to hold the barrels to the breech action is subjected to several hard blows of a hammer to test its rigidity before it passes out of the hands of the examiner into those of the borer and polisher, who bores and polishes the interior, at the same time chambering the barrels for the cartridges. Cost, 10d. The barrels are now given to the 'basculeur,' or action maker, by whom the breech action of the gun is carefully made of iron and steel. The material costs about 2s., and the labor about 28s. or 30s. The wood for the stock costs in this case 10d., and is given in the rough to the stock maker, with the barrel, breech action, and locks, which have been carefully fitted. The operation of shaping the stock requires much skill, and only a first class stock maker can be expected to give well finished lines to his stock—making stock, about 4s. The gun is again inspected, and given to the 'equipeur,' who adjusts the screws, etc. It is then taken apart and given to a number of workmen to finish the various parts, viz., to the 'systemeur,' who files the hammer to shape and receives 1s.; 'rhabilleur,' who does nothing but put the locks in order, and receives 2s. 9d.; 'polisseur,' who polishes the exterior and receives 6d.; 'derocheur,' who brings out the design of the damascus The operation requires about two days, but the workman has, of course, a great many on hand at once in different stages of preparation. This costs, say 10d. It is then given to the engraver. This operation may cost from 1½d., as on very common guns, to almost any amount. To the 'trempeur,' or casehardener, who hardens one-half of the exposed parts or 'furniture' of the gun is paid 1s.; to the bluer, who blues the other half of the 'furniture,' 5d.; incidental polishing, cost of screws, pins, triggers, sights, buttguard, name plate, and cost of adjusting same, 6s.; cost of locks, 4s.; refiling of stock, 'relimer,' 5d.; checkering stock, 'quadriller,' 7d.; oiling and finishing of stock, which consists in rubbing down to a polish with pumice stone and oil, 7d. The gun is then 'reassembled' by an 'assembler,' who returns it to the factory in working condition, and receives 5s. The gun is next repassed, that is, is completely taken apart, the interior of the locks, action, etc., polished, the springs tried, and everything adjusted to perfection, when several cartridges are fired to test the strength of the mainsprings. It is then oiled to prevent rust, and is ready for packing. This finishing and the various inspections that the piece is subjected to in the course of its construction cost about 4s. Packing is charged extra, and is, therefore, not included in the cost of the gun. Covers are put on, and twenty-five packed in a case. The total cost is 3*l.* 17s. 4d. The 'basculeur,' or man who contracts for the making of the breech actions, probably employs a number of men, and may make per day 4s.; the 'garniseur,' who puts the barrel together, perhaps 3s. 9d.; and the 'faiseur de bois,' 3s. 6d."

The cost of making a good "six shooter," in the rough, is said to be about 30 to 38 cents. The same weapon is retailed in England at half a guinea, and if nickeled at 15s. or 16s.

The extremely poor pay here indicated will account for much of the success claimed by the Belgian manufacturers in meeting their English and American competitors, notwithstanding that the latter have the advantage of the most improved machinery as against manual labor. In England it is said that the wages earned in Belgium would hardly suffice to keep an English mechanic in beer and tobacco, and there is doubtless a good deal of truth in the remark; but this only serves to illustrate and emphasize the unequal conditions under which the makers on both sides compete with one another.

### The Proposed Rocky Mountain Railway Tunnel

A project is on foot for tunneling the "Great Divide." The Divide is the Rocky Mountains, and the point proposed to be tunneled is under Gray's Peak, which rises no less than 14,441 ft. above the level of the sea. At 4,441 ft. below the Peak, by tunneling from east to west for 25,000 ft. direct, communication would be opened between the valleys on the Atlantic slope and those on the Pacific side. This would shorten the distance between Denver, in Colorado, and Salt Lake City, in Utah, and consequently the distance between the Missouri River, say at St. Louis, and San Francisco, nearly 300 miles; and there would be little more required in the way of ascending or descending or tunneling mountains. Part of the work has already been accomplished. The country from the Missouri to the foot of the Rockies rises gradually in rolling prairie, till an elevation is reached to 5,200 ft. above the sea level. The Rockies themselves rise at various places to a height exceeding 11,000 ft. Of the twenty most famous passes, only seven are below 10,000 ft., while five are upward of 12,000 ft., and one, the Argentine, is 13,000 ft. Of the 73 important towns in Colorado, only twelve are below 5,000 ft., ten are over 10,000 ft., and one is 14,000 ft. Passes at such a height are of course a barrier to ordinary traffic, and the railways from the Atlantic to the Pacific have in consequence made detours of hundreds of miles, leaving rich plains lying on the western slopes of the great snowy range practically cut off from Denver and the markets of the East. The point from which it is proposed to tunnel is 60 miles due west from Denver, and although one of the highest peaks, it is by far the narrowest in the great backbone of the American continent.

### Simple Water Tests.

*Test for Hard or Soft Water.*—Dissolve a small quantity of good soap in alcohol. Let a few drops fall into a glass of water. If it turns milky, it is hard; if not, it is soft.

*Test for Earthy Matters or Alkali.*—Take litmus paper dipped in vinegar, and if, on immersion, the paper returns to its true shade, the water does not contain earthy matter or alkali. If a few drops of sirup be added to a water containing an earthy matter, it will turn green.

*Test for Carbonic Acid.*—Take equal parts of water and clear lime water. If combined or free carbonic acid is present, a precipitate is seen, to which, if a few drops of muriatic acid be added, an effervescence commences.

*Test for Magnesia.*—Boil the water to a twentieth part of its weight, and then drop a few grains of neutral carbonate of ammonia into a glass of it, and a few drops of phosphate of soda. If magnesia be present, it will fall to the bottom.

*Test for Iron.*—1. Boil a little nut gall and add to the water. If it turns gray or slate, black iron is present. 2. Dissolve a little prussiate of potash, and, if iron is present, it will turn blue.

*Test for Lime.*—Into a glass of water put two drops of oxalic acid and blow upon it. If it gets milky, lime is present.

*Test for Acid.*—Take a piece of litmus paper. If it turns red, there must be acid. If it precipitates on adding lime water, it is carbonic acid. If a blue sugar paper is turned red, it is a mineral acid.

### Public Rights in the House Telephone.

We illustrated in our last issue the House Phonetic Receiver of 1868. It would be a matter of much interest to see how the Bell company would treat the extensive introduction of this device. If they tried to obtain a preliminary injunction, it seems doubtful if one would be granted, as it would amount to enjoining the employment of the device of an expired patent. If they failed in preventing the use of a pair of these instruments, it is not easy to see how one could be prevented from introducing an unpatented microphone in the same circuit. This would at once give a perfect telephone system. Were the House patent in force, the Bell company would undoubtedly try to secure it. As it has expired, the devices shown in it are public property.

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## HANDLING THE WATER FOR A GREAT CITY.

In former articles in the SCIENTIFIC AMERICAN we have described and illustrated many of the most prominent features of the water supply of this city, from the reservoir and well erected on the Collect more than a century ago up to and including the aqueduct now building. In the present article, we propose to describe how the water is handled after reaching the city—in other words, to tell how it finds its way into the large mains extending to different quarters. At this time this subject is particularly interesting, since the water to be admitted through the new aqueduct will have to be distributed by the old methods and appliances, which are considered fully capable of easily controlling the increased quantity.

[redacted] the whole of the present daily supply crosses the Harlem River over High Bridge, being conveyed from the Croton valley through what is generally known as the old Croton aqueduct. All of the water, except a small quantity pumped into a reservoir and high service tower located at the western end of the bridge, and such as is necessary to supply the district passed through, is then led to a gate house at 92d St. and 9th Ave. Part of this journey is made through a masonry conduit and part—that crossing the Manhattan valley—through cast iron pipes. At the gate house the water is divided, the smaller part going to the old reservoir in Central Park, which was built in 1842, and has a capacity of 150,000,000 gallons, while the rest enters the new reservoir, located a short distance north of the other, and which was completed in 1862, and has a capacity of 1,000,000,000 gallons. From the latter by far the larger portion of the supply is sent into the city, and it may therefore be considered the principal distributing center.

The new reservoir is divided into two sections or ponds by a wall extending across it. The water is admitted through a gate house at the northern extremity of this wall into either of the ponds. At the southern end is the main gate house, the valve chamber of which is illustrated in the engraving upon this page. Within the house is a large rectangular chamber or well, into which the water enters through valves, so placed that either side of the reservoir may be drawn from. The water passes from the well into six 48-inch cast iron pipes, five of which connect with the general distributing system, and one of which communicates with the old reservoir, that furnishes the supply for the western portion of the city, through two 48-inch pipes.

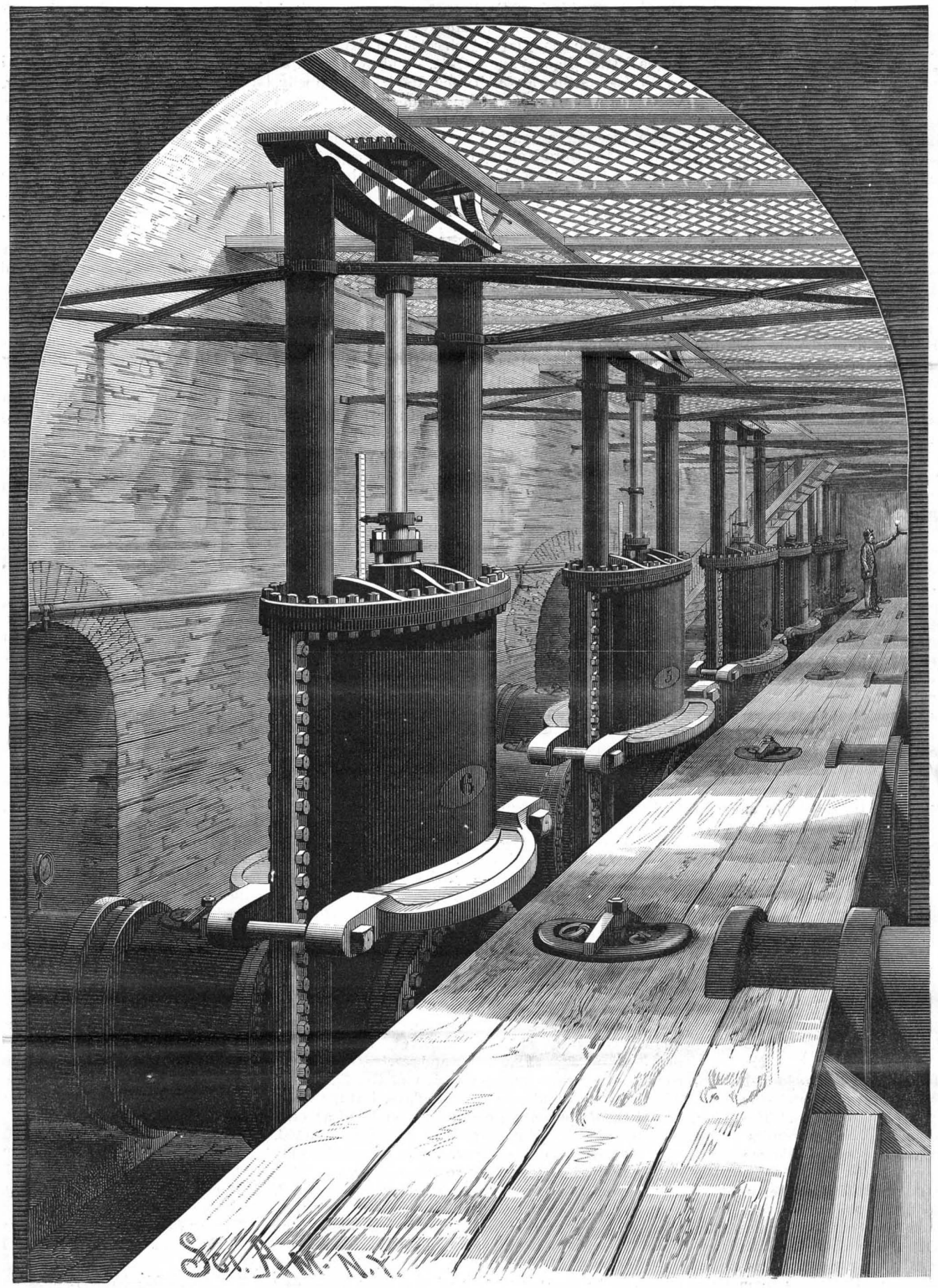
Each of the pipes is provided with a valve, which is operated by a screw turned by a hand wheel. A scale, graduated to feet and inches, is so arranged that the exact opening of the valve can be seen at a glance. Owing to the inadequacy of the present supply, these valves are opened but a short distance under ordinary circumstances. The gate house is in telegraphic communication with the fire department, so that whenever required a request can be sent for more water. Until recently such a request could not be quickly complied with, as it took at least half an hour to open one of the valves, the great weight of the valve itself and the pressure of the water against it rendering the work very hard and necessarily slow. This defect has been obviated by the introduction of two butterfly valves, which can be opened by one man in ten minutes.

These reservoirs also supply the high service station at 97th Street and 9th Avenue and the distributing reservoir at 42d Street, which will hold 24,000,000 gallons.

The gate house for the new aqueduct, which, when running full, will have a daily capacity of 250,000,000 gallons, will be located on the corner of 135th Street and Convent Avenue. Its outside measurements will be 100 by 56 feet. The illustrations comprising our frontispiece convey a clear idea of the general appearance of the building and of the arrangement of the interior. The exterior will be built of granite of contrasting shades, with hammer-dressed light granite trimmings. In the interior the water chambers and gateways will be faced with granite, and the stop-cock chambers on the south side of the main chamber and the vertical portion of the aqueduct inlet will be of brick. The roof will be iron trusses covered with slate laid in mortar. The top of the tower will be at an elevation of about 170 feet above tide level.

The interior is divided into two main water compartments. The larger one is 12 feet wide by 70 feet long, and receives the water directly from the aqueduct shaft, which is placed in the center of the tower, and rises about 40 feet above the aqueduct line. Alongside of this compartment are eight others, each 6½ feet wide by 9 feet long, the dividing walls being 2½ feet thick. In the walls are formed grooves for the reception of screens or stop planks. From these chambers the water passes through a slide gate (which serves to shut off the water in case the stop-cock valves need repairing) in each into eight 48-inch mains. In a third set of chambers, each of which is 7 feet wide and 12 feet long, the mains are provided with stop-cock valves. The accompanying plan and interior views plainly show the course taken by the water in its passage through the several chambers from the aqueduct to the eight mains. Four of these mains lead the water to the new reservoir in Central Park, from whence it will pass through the gate house first described into the distributing mains. The other four will connect with the general system at points along the route of the first four. A circular conduit, 10 ft. in diameter, indicated on the plan view, will connect with the present aqueduct at 135th Street and 10th Avenue. The depth of water in the entrance chamber to this conduit will be about 20 ft., while that in the main chamber will be 40 ft.; the water will be controlled by four gates operated, like all the others, by hoisting machinery on the floor above, connected with the gates by rods. The stop cocks will be operated from platforms below, as shown in the large view of the interior.

The estimated cost of the structure, which is to be completed on or before Sept. 30, 1887, is $250,000.



NEW YORK CITY WATER SUPPLY.—VALVE CHAMBER IN GATE HOUSE, CENTRAL PARK RESERVOIR.

### A Monster Gun.

What must be considered the heaviest gun at present in existence has been just shipped at Antwerp for Italy. It was manufactured by Krupp, is 46 ft. long, weighs nearly 116 tons without the breech piece, and 118 tons 3¼ cwt. with the breech. It arrived at Antwerp on a specially constructed carriage, 105 ft. long, and running on 32 wheels. It was at first intended to send the gun overland; but the St. Gothard railway and other Swiss railways objecting on account of its great weight, and fearing for their bridges, the weapon had to be taken to Antwerp, and thence forwarded to Italy by sea. Its ultimate destination is said to be Spezia, where it is to be mounted in one of the iron-clad ports guarding that harbor.

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### EFFECT OF THE EARTHQUAKE ON THE SOUTH CAROLINA RAILWAY.

Never before in this country has there been, and it it is to be hoped never again will there be, opportunity to present such a picture of the effect of "the bottom dropping out of everything" as that which we present in this issue in our engraving (an exact reproduction of a photograph) of what was left of what had before been a tangent on the South Carolina Railway, near the point where a bad accident and worse scare occurred on the night of the earthquake of August 31, and where (we presume) the dislocation was exceptionally severe. It hardly seems possible that the sharp curve in the foreground can be wholly due to a permanent dislocation of the surface, but we are informed that it was, as also the quick drop in grade in the "middle distance." The photograph gives obscure evidence of still further dislocations in the background, which has been rather softened than obscured in the engraving.

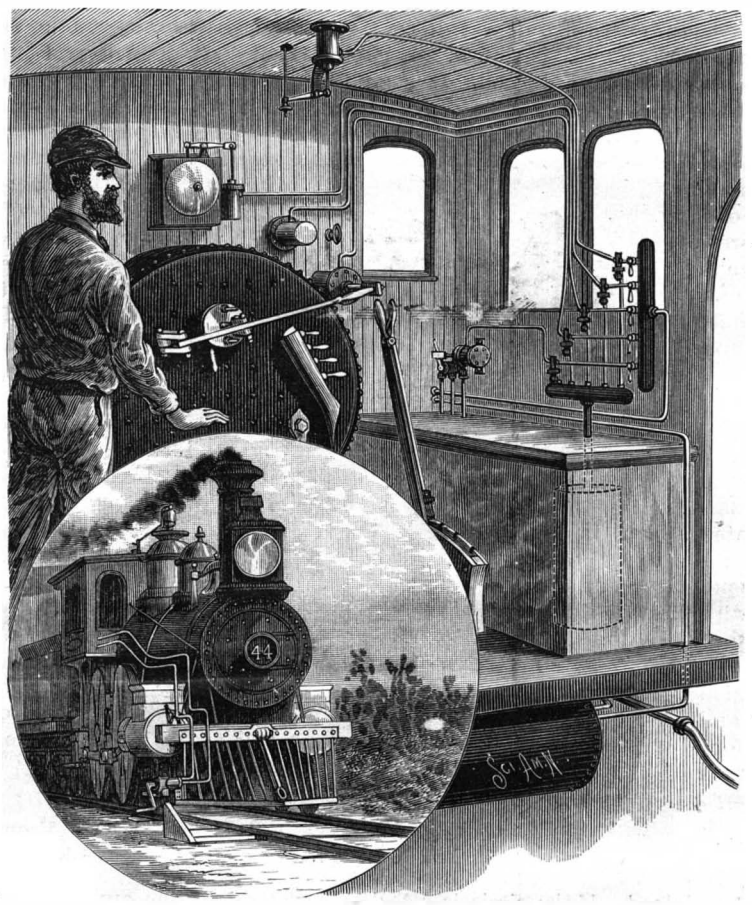
The Charleston & Savannah road is said to have suffered on the whole even more severely than the South Carolina or the Northeastern as respects dislocation, although all the serious wrecks occurred on the other lines. Accounts of three of those wrecks, including the one near the point illustrated, were given in our issue of September 10, as also a description of the accompanying "quakes." In connection with this engraving, the nature of the catastrophe, and the fact that the description is probably not exaggerated, can be better appreciated, and we therefore reproduce the substance of it:

"Near Ten Mile Hill a fatal accident occurred on Tuesday night. The down Columbia train (South Carolina Railroad) jumped the track under the unseen influence of the shock that dismantled the road. It is said that the earth suddenly gave way, and that the engine first plunged down the temporary declivity. It was then raised on the top of the succeeding terrestrial undulation, and, having reached the top of the wave, a sudden swerving of the force to the right and left hurled the ill-fated train down the embankment.

"How it was done was plainly indicated. In many places along the track of the South Carolina and the Northeastern railroads; and for spaces of several hundred yards in width, the dreadful energy of the earthquake was expended in two particular ways. First, there were intervals of a hundred yards and more in which the track had the appearance of having been alternately raised and depressed, like a line of waves frozen in their last position. The second indication was where the force had oscillated from east to west, bending the rails in reverse curves, most of them taking the shape of a single, and others a double letter S placed longitudinally. These latter accidents occurred almost invariably at trestles and culverts. There were no less than five of them between the Seven Mile Junction and Jedburg. In other places the track had the appearance of being kinked for miles, but always in these cases in the direction of the rails.

"The train at the time of the earthquake was running along at the usual speed, and when about a mile south of Jedburg it encountered a terrible experience. It was freighted with hundreds of pleasure seekers returning from the mountains. They were all gay and happy, laughing and talking, when all of a sudden, in the language of one of them, the train appeared to have left the track, and was going up, up, up into the air. This was the rising wave. Suddenly it descended, and as it rapidly fell it was flung first violently over at the east, the side of the car apparently leaning over at less than an angle of 45 degrees. Then there was a reflex action, and the train righted and was hurled, with a roar as of a charge of artillery, over to the west, and finally subsided on the track and took a plunge downward—evidently the descending wave. The engineer put down the brakes tight, but so great was the original and added momentum that the train kept right ahead. It is said on trustworthy authority that the train actually galloped along the track, the front and rear trucks of the coaches rising and falling alternately. The utmost confusion prevailed, women and children shrieked with dismay, and the bravest hearts quailed in momentary expectation of a more terrible catastrophe. The train was then taken back in the direction of Jedburg; and on the way back the work of the earthquake was terribly plain. The train had actually passed over one of those serpentine curves already described."

Two other accidents of the same general nature were likewise described in the same issue. The only pleasant feature in these occurrences, to a railroad man, is that at least it can be said of them, with literal and indisputable truth, that "no one was to blame."—*Railroad Gazette.*



CHASE'S AUTOMATIC ATTACHMENT FOR LOCOMOTIVES.

### AUTOMATIC ATTACHMENT FOR LOCOMOTIVES.

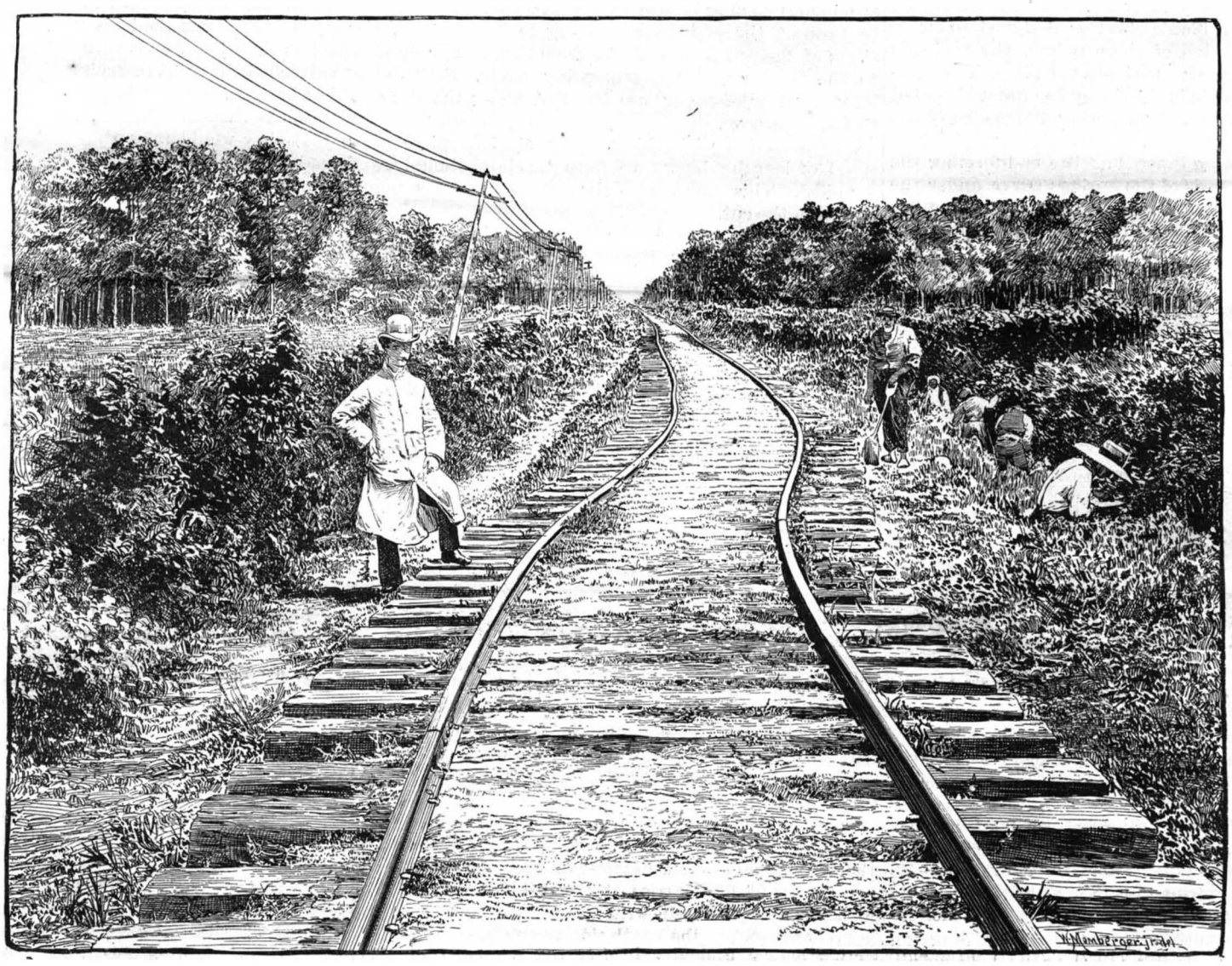
The purpose of this attachment is to prevent accidents and collisions by a more effective safeguard than has heretofore been devised. It not only gives warning of the impending danger to the engineer, but itself absolutely stops the train. If, for any reason, the engineer should fail to notice a signal, [illegible] puts it in the power of every trainman, or watchman at any point along the [illegible] Di- to stop the train in time to prevent accident, even if the engineer had for any reason left his engine.

Attached to one side of the cow-catcher of the locomotive is a three-way cock, the lever for operating which projects at one side, so that an obstruction placed alongside of the track will operate the cock as the locomotive moves past. The movement of this cock admits air, obtained from the usual compressed air reservoir supplying the brakes, to five small cylinders. The shifting of the piston of one of these cylinders admits air to a pipe for applying the brakes, the second piston operates the throttle valve, the third opens the sand valve for sanding the track, the fourth rings a gong bell placed within the cab, and the fifth opens the valve of the steam engine. The mechanism for accomplishing these operations is so simple as to obviate all danger of getting out of order and to render certain the working of the entire system. It will be understood that these devices may be so arranged as to all operate at the same time or singly, as may be desired.

The inventor of this attachment for locomotives, Mr. Norman F. Chase, of Montrose, N. Y., presents the following advantages and reasons why it should be extensively adopted: First, the absolute certainty of preventing accidents and loss of life; second, preventing destruction of property; and third, economy in first cost and in use, as all lights can be dispensed with if desired.

### The Trials of an Inventor.

M. Juibert, a mechanical engineer of Paris, recently made an invention which is said to increase materially the speed of railway travel. The journals discussed the matter at length and predicted for M. Juibert a great future. However, the other day, as the inventor sat in his workshop, a stranger suddenly rushed toward him and began belaboring him with a cane, exclaiming excitedly: "This will teach you not to make such murderous inventions that will enable my mother-in-law to reach my house in six hours instead of in twelve." M. Juibert caused the arrest of his assailant, who is said to be a well known merchant by the name of Bolivet.



THE SOUTH CAROLINA RAILWAY.—VIEW NEAR TEN MILE HILL AFTER THE EARTHQUAKE OF AUG. 31, 1886.

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### A New Petroleum Engine.

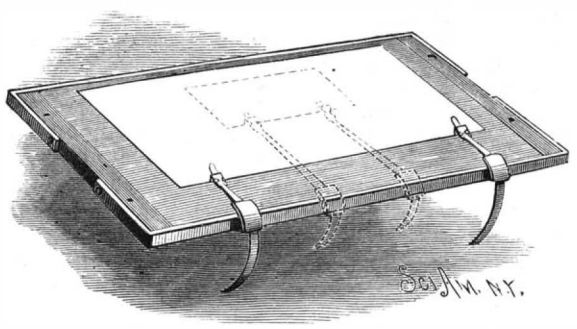
To produce a small engine that can be operated by the combustion of petroleum is a problem that has received the attention of quite a number of our best inventors. That there is a great demand for small power machines there is no question; and the almost unlimited supply of petroleum, and the low price it is sold for, induce the seeker for a cheap, small power to turn his thoughts in the direction of petroleum for the fuel.

The English newspapers make mention of a new petroleum engine just brought out, which they claim has less objectionable features than most other petroleum engines which have been tried.

The trial experiments were made at Messrs. Priestman Brothers, Holderness Foundry, at Hull, England. The petroleum is stored in a small tank containing one to two days' supply, as the case may be. A small pressure of air is put into this tank and the petroleum is forced out of it into a vessel in a vaporized condition, in which it is then drawn into the cylinder by the outstroke of the piston; and having been compressed on the instroke, the charge is ignited by means of a small electric spark. This immediately explodes the contents in the cylinder, and the piston is driven forward. The engine in which the highly refined petroleum is used is very similar to that in which the common petroleum is employed, the only difference being that in the latter engine the oil is taken into the cylinder in a heated condition. The cost of the oil is estimated at a halfpenny to three farthings per indicated horse power per hour. Four horizontal engines were at work, two with benzoline and two with common petroleum. One of about three and a half indicated horse power, supplied with benzoline, was driving easily four blasts at which chainmakers were at work, besides a punching and a shearing machine. A vertical engine of about four horse power was driving a tram car, and doing work with ease. The tests were considered by the invited engineers and reporters present to have been most satisfactory.

### GAUGE ATTACHMENT FOR PRINTING PRESSES.

The platen of the press is provided with the usual clamping bars, which are pivoted to its side edges and are swung down over the edges to hold the sheets of paper placed upon the platen. One end of a curved spring is turned at right angles and formed with two sharp points that engage with the tympan sheets. Through a slot in the turned edge projects a tongue, connected to the end of the spring by clips, and which serves to retain the sheets of paper and cards, and prevent their slipping over the gauge. The spring slides adjustably through a slot in a plate bent to such a curvature as to hold the spring in the slot to any desired adjustment. This plate is furnished with a blade so arranged as to pass between the edge of the platen and one of the clamp bars, and thereby hold the plate and its spring in position. The spring, the normal shape of which is curved, lies flat against the tympan sheets, with the points in the sheets just where the edge of the card or blank sheet is designed to come. To change the position of these points, the spring is simply slipped through the slot in the plate. Two positions of the points are indicated by the full and dotted lines of the engraving. The spring lies perfectly flat against the tympan sheet, this result being obtained by making the spring tapered at the end forming the gauge. The free ends of the springs curve under the platen and are out of the way. In this gauge there are no prongs to stick through the tympan sheet and cardboard, and thereby spoil the sheets and injure the surface of the cardboard. It is very easily adjusted in place, and the spring may be drawn out and the gauge



BYINGTON'S GAUGE ATTACHMENT FOR PRINTING PRESSES.

placed exactly where the sheet is to be held. The gauge can be instantly changed to any extent.

This invention has been patented by Mr. F. F. Byington, whose address is care of Pacific Press, Oakland, Cal.

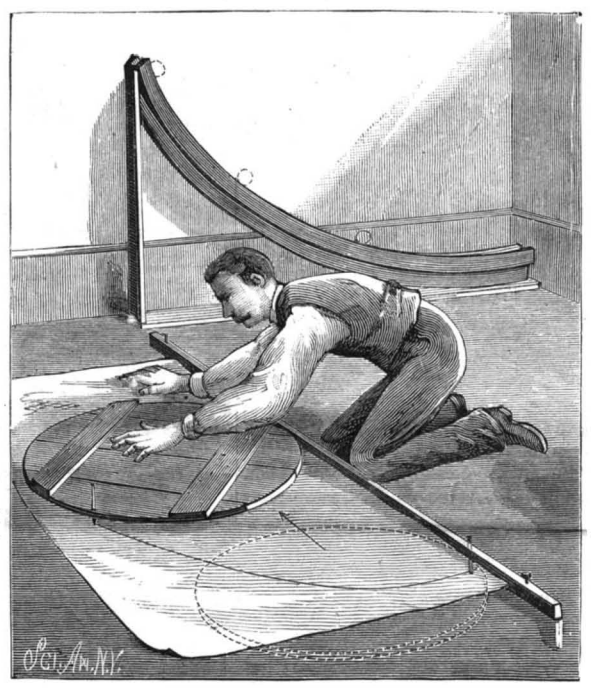
In dead subjects of yellow fever, the heat has been known to run up as high as 113° F. three hours after death, when it was only 104° as life passed from the body. The rise of temperature is supposed to be due to a fermentation of the blood.

The beneficial results of quinine in breaking up malarial and other fevers are supposed to be principally due to the power the drug has to arrest fermentation and putrefaction. Quinine is an anti-ferment. Malarial fever is supposed to be due to the presence of fermenting spores in the blood.

### THE CYCLOID.

T. O'CONOR SLOANE, PH.D.

One of the laws of descending or falling bodies is illustrated in the cut. An easy method of drawing the curve of quickest descent, the "brachystochrone," or cycloid, is shown. A circle is cut out of stiff pasteboard or wood. It should be two feet in diameter at least. A batten is nailed or secured to the floor, or the surbase of a room may be utilized in-



THE CYCLOID.

stead. If the circle is rolled along a straight line, any point on its circumference will describe a cycloid. To trace the curve, a pencil is fixed as near the periphery of the circle as possible. A piece of paper is pinned to the floor, as shown, and the board placed with the pencil at its point of tangency with the batten. Now, on rolling the board along the batten, taking care that a true rolling motion is produced, the pencil will describe a cycloid. Only half need be traced; the full curve is not wanted. Care must be taken that the board does not slip or slide on the strip, or the curve will not be a true one.

This gives the pattern; a piece of wood about three-quarters of an inch thick must be cut to this shape. The wood is best glued up from several pieces, and may then be made quite light and narrow, top and bottom being equidistant, the one forming the half-cycloid drawn, and the other a parallel curve, about two inches coming between them. A foot is arranged to support the end corresponding to the initial position of the pencil, at a height from the ground equal to the diameter of the generating circle. Strips of light wood or of paper are fastened along the sides, to form a groove.

In connection with this curve, a straight piece of wood of length adapted to form its chord should be supplied. This must also be grooved. It is not shown in the cut.

If a marble is released from the top of the cycloid, it will roll down in less time than if it followed any other curve or line extending from the point of starting to the end. The straight piece may be arranged to occupy the position of a chord to the cycloid, and held there. If two marbles are simultaneously released, one from the top of the cycloid, the other from the top of its chord, the one following the curve will always reach the bottom first. The steep descent of the first portion of the curve gives such a start to the marble that it distances its competitor always. One curious feature is that the marble traveling the quickest from point to point does not follow the shortest line—the straight one, or chord of the cycloid.

Other curves may be tried with the same result. The cycloid is always the quickest road. Not only is it this. It also has the curious property that from whatever point a marble is started, all will reach the foot at the same time. This illustration is, if anything, more effective than the other. A marble is released from the top simultaneously with one from any intermediate point. Just as the first one reaches the end, the other one will strike it. It is quite immaterial what points are selected. The same period is always required for the transit to the foot. This property of isochronism makes it the proper curve for a pendulum. In practice, as it would involve a certain amount of complication, it is not used in clocks. For accurate ones, a pendulum swinging through a very small arc of a circle is used. This does not differ enough from a true cycloid to cause any practical difficulty in securing a good time regulation.

### The Invention of the Sextant.

Dr. J. L. Dreyer points out, in the *Astronomische Nachrichten*, No. 2,739, an historical error which has crept into several astronomical works, although it was refuted some fifty years ago by Prof. Rigaud in a series of papers communicated to the *Nautical Magazine*. In the books referred to, it is stated that the principle of the construction of the sextant was communicated to John Hadley by his brother, a Captain Hadley, who had in his possession a sextant given to him by Capt. Godfrey, brother of Thomas Godfrey, of Philadelphia, the real inventor of the instrument. But it appears there never was such a Captain Hadley. The brothers of John Hadley were, one a barrister, the other a physician; and he himself was not an instrument maker by profession—as has been asserted—but as an amateur occupied himself with mechanical pursuits, and was the first to bring the polishing of reflecting telescopes to any perfection.

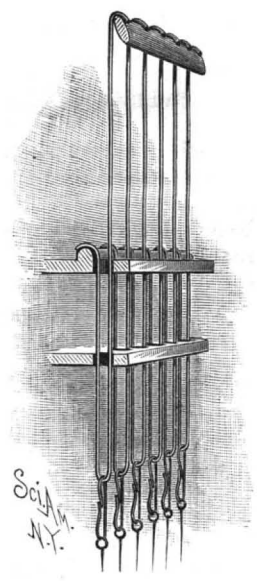
On May 13, 1731, John Hadley communicated to the Royal Society a description of his reflecting octant; and, after some hesitation, Halley declared himself satisfied that Hadley's idea was quite different from that of Newton, who had invented an instrument founded on the same principle. It is no doubt true that Thomas Godfrey, a glazier of Philadelphia, had invented an instrument of this kind about the year 1730; but the first intelligence of his invention did not reach England before the month of May, 1732, in a letter from James Logan to Halley. Godfrey's instrument was made of wood by Emund Woolley, a carpenter, about November, 1730, and had been tried on board the ship Truman, of which John Cox was master. The first model of Hadley's octant had, however, been constructed by his brother George about the middle of the summer of 1730.

### Spring vs. Autumn Planting.

From long and extensive experience in planting in different situations and soils, I am in favor of autumn planting of forest trees, and also evergreen shrubs, unless in cold, bleak situations, when the latter are best deferred until spring or early summer. There may be situations where the soil is too wet to admit of early planting, but such is unfit for planting at any season till drained. There is an old saying, which in practice I find to be correct, viz., "Plant a tree in autumn and command it to grow; but in spring you must coax it." Some are of opinion that severe frost will injure early planted trees. This I have proved to be a fallacy. In order to test it, I left young trees with their roots uncovered during severe frost, and planted them when thawed, and I found that they sustained no injury. There is more risk from drought in spring planting than from frost in autumn or winter planting.—*J., in London Garden.*

### IMPROVED JACQUARD MACHINE.

In the ordinary Jacquard machines, the devices carrying the harness of the loom consist of iron hooks provided on their lower ends with twisted cords, to which are attached the collets carrying the respective threads of the harness. It has been found difficult to make these cords the same length, so that they would raise the threads of the harness equally. The invention herewith illustrated, which has been lately patented by Mr. James Jackson, of 18 and 20 Albion Street, Paterson, N. J., dispenses entirely with the twisted cords, and attaches the collets carrying the threads directly to the hooks.



Each hook consists of a vertical rod formed at its upper end with a bend, which engages in the well known manner with the cross bar attached to the lifting frame, which raises the hooks and, consequently, the harness of the loom, in the usual way. The lower part of the rod is bent upon itself, and in the bend is hooked a collet formed of spring wire bent and twisted, as shown. Each thread of the harness is provided with the usual loop on its upper end, which is hooked to the collet. The parallel parts of the wires, by passing through apertures in the stationary grates, are guided in their up and down motion in such a manner that the hooks retain their relative positions to each other, having no sidewise or endwise motion whatever. On the lower end of the hook is a bend that passes over a ridge on the upper grate, in the downward movement of the hook. This prevents the hooks from going further down, and they assume the same position they had before being raised. In transferring the threads from one machine to the other, the upper ends are simply unhooked from the collets, or the latter are removed from the hooks.

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### FISHES OF THE MALAY ARCHIPELAGO.

Although New Guinea and the Moluccas are the countries of natural wonders, the seas which surround and separate them contain the strangest and most interesting forms. In the lower depths of these coral seas, the most beautiful fishes sport in the blue yet transparent water, and cause their lace-trimmed, diapered robes to shine and sparkle, and their scales to glitter under the ardent rays of the sun.

Among other points in New Guinea, the harbor of Dorey seemed at the time of my first voyage, in 1877, peculiarly favored in this respect. There did not a day pass in which my little squad of youthful fishermen (all the children of the village, excited by the bait of glass trinkets) did not bring me some fish that was new to me; and I soon collected a large number. Being at this time disabled, through fourteen wounds on my right leg, that condemned me to keep to a forest house for more than six months, while Mr. Raffray was successfully exploring the W. Schouten and Amberbak islands, I found it a diversion to direct this little maritime station. Not satisfied with collecting the fishes, I applied myself to keeping them alive (if only for a few hours), in order to make rough colored models, ~~capable of~~ recalling those brilliant colors that cannot be preserved after the death of the animal.

Dr. Vaillant, professor at the Museum and custodian of these models, has recently had the goodness to send them to me; and, thanks to him, I have been enabled to have Mr. Clement figure two of the inhabitants of the seas of Papua, one of which is more remarkable than all the others, by reason of its odd form.

In 1767, Commerson founded the genus *Zanclus* (a word of Greek origin, meaning pruning knife) for the singular fish shown in the lower part of the engraving, and gave a description and very accurate colored representation of it. Seba had already figured it, and there are few authors who have not reproduced the image of it.

This fish is none the less remarkable by reason of its color than by that of the round and compressed form of its body, and of the little snout, at whose end the mouth opens, and of the long appendage to the dorsal fin.

The ground of its livery is yellow and white, with three wide black bands. The first of these latter extends from the back to the ~~ventral fin~~ (which also is black), and is provided with a white line over the eye and two parallel white ones near the ventral fin.

The second black band extends from the center of the last ray of the dorsal fin up to the anal, which it almost entirely covers, and is traversed longitudinally behind by a fine white line that continues more or less uninterruptedly up to the external edge of the anal fin. From the tail detaches itself the third of these black bands, and the white extremity of this forms a crescent, which is externally bordered by gray.

Between these black bands there are large yellow areas. Between the first black band and the yellow there is a long white stripe that covers a portion of the dorsal fin, and that joins or blends with the white tint of the belly. A white band also is to be seen near the last black one, or, more properly, the tail is white and is traversed by a wide black band.

The entire front portion of the fish, the snout included, is white; but the lower jaw is black, and upon the upper one there extends on each side an orange-colored triangle, circumscribed with black—the black border running to the orbital horns. The eye is of a sepia brown, with a black pupil.

Such were the colors of the specimen that I painted at Dorey in April, 1877. The colors as given by Cuvier, from a painting of Commerson's, and from quite fresh alcoholic specimens collected by Lesson and Garnot, are about the same as those noted above, and show that this fish has always been well known. Mr. Vaillant has had the goodness to send me likewise a model made in the Sandwich Islands in 1874 by Mr. Ballieu, the French consul, and in which may be quite well seen the fundamental tints of this fish. The specimen that I painted in New Guinea wanted the long filament that terminates the dorsal fin. Mr. Ballieu represents this appendage as yellow fringed with black.

The scales, which are vertical, narrow, and short, lie very close to each other, and are so small that they give the body a rough appearance, somewhat like that of shagreen.

The little points or horns that project above the orbits have given this fish the specific name of *cornutus*. But in its native country the fish has many other names. The Mafors call it *inn acis*, "comb fish," on account of the arrangement of its dorsal fin, which is high and narrow, and somewhat resembles the wooden fork with which these Papuans comb their bristling hair. The Dutch colonists of the Moluccas know it under the name of *besant*, since the discoidal form of its body makes it resemble the piece of arms known under that appellation in the heraldic art; and the same Dutch call it also by names signifying "the pikeman," "trumpet," and "ensign bearer."

Renard calls the *Zanclus*, *Moorse afgodt*, "idol of the Moors," and *apropos* of this says that the Malays have a great fear of the fish, based upon a superstitious veneration. So they make haste to throw into the sea every fish of this species that happens to be taken in their nets, and this, too, with many marks of respect and many genuflexions.

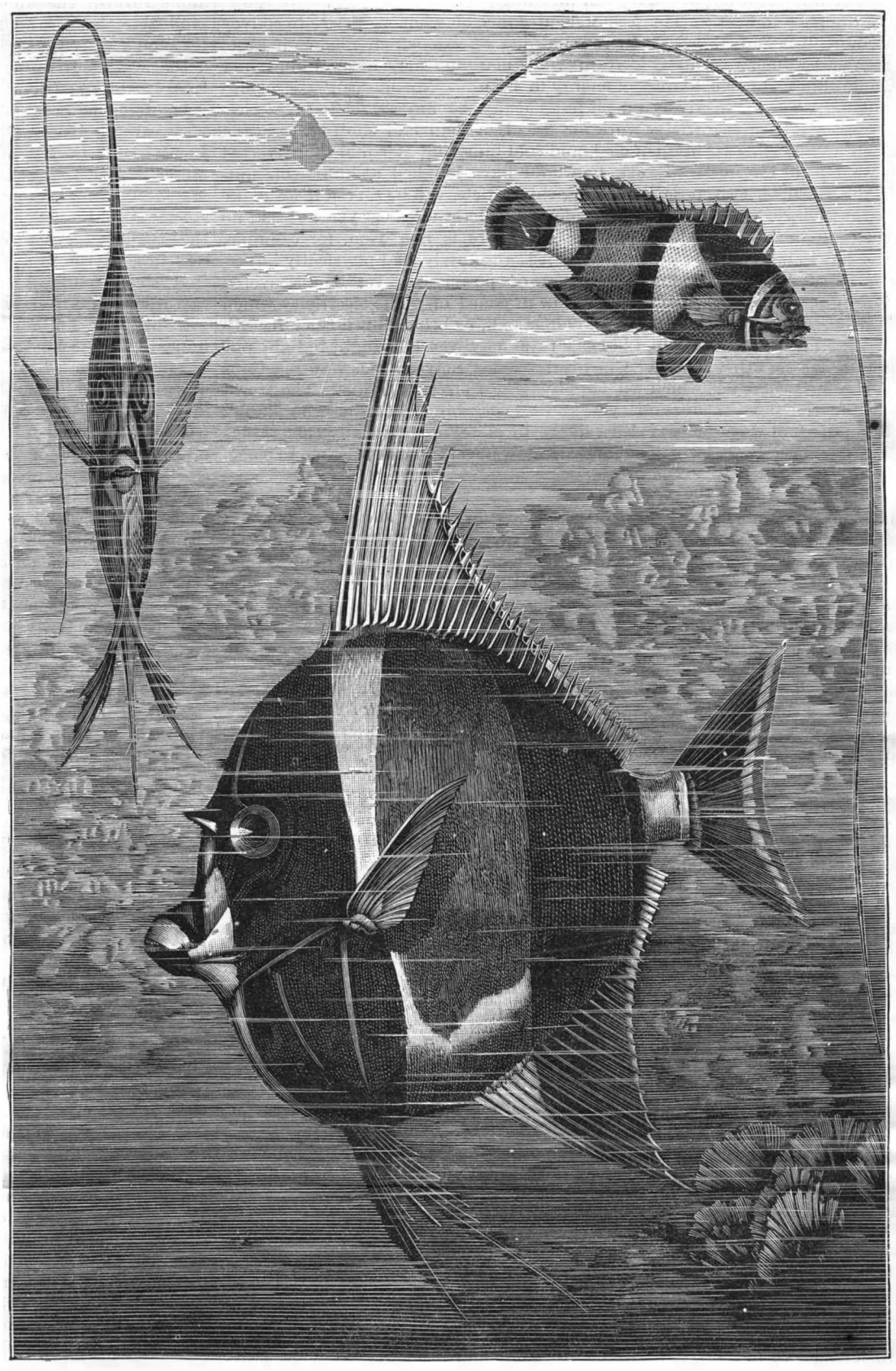
On another hand, the flesh of this fish appears to be much esteemed, and in taste approaches that of the best pleuronectes. Ruysch even says that in Amboyna no banquet or fine meal is given at which these fish are not served. We have here a sea divinity that is variously appreciated.

The *Zanclus*, without ever reaching a very large size, weighs at times as many as 18 pounds. It is met with from Mascareignes up to the Pacific islands of Tongatabou, Vanicoro, and Sandwich.

Two other species of it are known, that inhabit the same regions; and one fossil form has been described by Agassiz.

The small fish figured at the top of the engraving belongs to the genus *Amphiprion*. Cuvier and Valenciennes have given it the specific name of *tunicatus*, and in their great work we find a faithful image of it taken from specimens collected by Lesson and Garnot at Vanicoro. The individual that I painted at Dorey was of a beautiful red-lead color, with black bands circumscribing three areas of light blue. The first blue band formed a half circle on a level with the gills, and the second, or central one, was larger and triangular, and ran point-wise toward the pectoral fin. A wide black blotch occupied the back and extended from the first blue band to the first half of the dorsal fin. The third blue band, which also was bordered with black, was situated behind the dorsal and anal fins. These latter, as well as the caudal ones, terminated in a rose-colored band.

The genus *Amphiprion* is represented in New Guinea by numerous species, that vie with each other in brilliancy. In size, they are always small. These pretty little fishes live amid corals and in holes in madreporic rocks. Sporting or pursuing each other with vivacity, they are often surprised by the falling tide, and have to continue their frolic in small puddles of water until the rising tide carries them away.—*M. Maindron, in La Nature.*



THE PRUNING KNIFE FISH (ZANCLUS) AND OTHER FISHES.

### To Tell the Age of Eggs.

We recommend the following process (which has been known for some time, but has been forgotten) for finding out the age of eggs and distinguishing those that are fresh from those that are not. This method is based upon the decrease in the density of eggs as they grow old.

Dissolve two ounces of kitchen salt in a pint of water. When a fresh laid egg is placed in this solution it will descend to the bottom of the vessel, while one that has been laid on the day previous will not quite reach the bottom.

If the egg be three days old it will swim in the liquid, and if it is more than three days old it will float on the surface, and project above the latter more and more in proportion as it is older.—*La Nature.*

### Simple Millinery.

The Audubon Society and individuals interested in the protection of birds have for some time protested against the slaughter that is going on to supply the demand created by the fashion in ladies' hats. It was thought to be an easy matter to at least lessen the practice of shooting singing birds for the market, as it is in clear violation of the statute. But it seems that singing birds are not wanted at all for ladies' hats; that the many varieties of snipe are most in demand, gray being the fashionable color; and that neither for export nor for home use are song birds now shot. This puts a different aspect on the matter, for snipe being game birds, it is not illegal to shoot them in season; and so far as cruelty is concerned, of which so much has been said, it is not more cruel to shoot birds for decorating hats than it is for the table. There are over fifty varieties of snipe that visit the Long Island shores.

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### Sources of Power.

In the older treatises on mechanics we find the sources of power classified under the heads "Wind, Water, Steam, Animals;" and, broadly speaking, these are still the only sources of power we possess. But when we deal more in detail with the subject, we find that wind, in all probability, owes its capacity for performing work to the sun, while water is absolutely inert save as actuated by gravity, and steam is, of course, merely an agent by which heat is converted into work. Concerning the methods by which animals perform work, we are entirely ignorant, no physiologist having as yet succeeded in tracing the sequence of processes by which food is converted into mechanical energy. Enough is known, however, to show that the process has nothing in common with that by which work is performed by heat engines. So that the analogy sometimes drawn between a man and a machine must be rejected as far-fetched, permissible to the poet, indeed, but not to the philosopher. Furthermore, it is known that the work got out of food by men and animals is much greater, on the whole, than can be obtained from fuel consumed in the best steam engines. That is to say, a man or a horse may be more economical sources of energy, in one sense, than any machine. Be this as it may, it is sufficiently evident that we depend for the performance of all the work done in the world on two main sources of power—heat and vital energy. The action of gravity, it is true, causes the falling of water, and so gives out power; but the water has to be raised before it can fall, and this raising is effected by the heat of the sun, which evaporates moisture, and so indirectly gives us clouds and rain.

It appears to be not unreasonable that men should ask themselves now and then if there are no other sources from which power may be derived—is there no other force of nature that can be made the slave of man? The question has been put in hundreds of ways, and remains unanswered.

In dealing with this question of sources of energy, it seems to be not impossible that a misapprehension of the nature and bearing of the laws of the conservation of energy may do a great deal of harm. It may be said, for example, that it is quite useless to search for a source of energy which can be better or more economical than we have now, and much more to the same effect. But let us ask ourselves what is this law of the conservation of energy, on what is it based, and what would be the consequences to the universe if it did not exist? Such questions are very seldom asked, because the number of men who are at the pains to think for themselves is small. But when they are asked, the answer is remarkable. There is really no reason at all why energy should be conserved, and so far as our senses supply evidence, far from being conserved, it is being profusely wasted every day. Of course, if we go a little behind the evidence of our senses, we find that the waste is only apparent, not real. It is much easier, however, to form an idea of a universe in which the law of the conservation of energy has no existence than it is to realize a fourth dimension in space, or even the life of the inhabitants of Flatland. As a help to the realization of such a universe, we may point to the fact that the sun has been giving out energy for millions of years, and that there is no reason whatever to think that he has lost any portion of his original heat. In other words, it is simply impossible to prove that what we call energy is not created in the sun.

Again, let us take gravity. We have here the most stupendous force in nature. There is no reason to imagine that it is capable of degradation. If all the planets fell into the sun, gravity would of necessity have performed an enormous amount of work; but no one can say that after it was done gravity would be any weaker. It may indeed be said that the law of the conservation of energy has only just missed being disproved, if the words "conservation of energy" be used in one sense. So far as can be seen, there is no reason why the line of magnetic force should not behave like lines of electric force or heat force, and admit of being intercepted or stopped. It would then suffice to put a permanent magnet under one end of a beam, the other end of which should be connected in the usual way with a crank and flywheel. Then by interposing and withdrawing a thin intercepting plate at the proper intervals, we should have a machine which should work steadily until it was worn out, without the expenditure of one farthing for fuel. In the popular sense of the word, we should create power; and the perpetual motion men would spend their lives in patenting details, while the principle would be public property. Has any one the least idea why magnetic force lines should traverse every known material? Can any one assert that if this was not the case the existence of the universe would be impossible or even difficult? Can any one assert with certainty that no means will ever be found for intercepting or dissipating magnetic rays, without expending energy in doing so? Finally, is it not possible to obtain some idea of the cause of magnetic force from this very peculiarity of its behavior? To put an extreme case, it may be urged that the law of the conservation of energy being true, it is impossible to intercept a magnetic force line. What, then, is the nature of the force which will comply with this condition? On the other hand, it is possible to intercept a heat, light, or electrical line, and yet the law of the conservation of energy is not interfered with—*ergo*, magnetic force must possess features which distinguish it from the other forces we have named; from all other forces, indeed, save gravity. One deduction seems to be consistent with facts, namely, that magnetism and gravity are original or primal forces, and that the remaining forces—such as light, heat, and electricity—are derived, built up, or composite forces. That, in a word, gravity and magnetism are elements, while light, heat, and electricity are compounds. We speak of light, heat, and electricity as "forces;" perhaps it would be more strictly correct to speak of them as manifestations of force. But what we have written will serve sufficiently well to convey our meaning.

The sum and substance of what we desire to convey is that there is nothing known which renders it absolutely certain that mankind may not yet find new sources of energy in nature. No one can assert positively that it must always be impossible to make electricity work for us. If a man had shown Socrates a lump of coal, and told him that it could be converted into work, he would have laughed at him. Our purpose in writing this article will be served if we make our readers understand that there is as yet, at least, no finality in science. There is no reason, for example, to conclude that it is absolutely and physically impossible that sources of power may yet be discovered which are not now dreamed of. The electricity which now rends the forest oak, or brings down the lofty edifice in a hideous ruin, may yet be taught to light our towns. Chemical science may give us new reactions which will supply large sources of power. The world does not yet know everything; and he who knows most is least likely to assert dogmatically that things which do not exist now never can exist in time to come. —*The Engineer.*

### Steel Pipes for Water Mains.

The Works Committee of the Dundee Water Commission recently instructed their engineer, Mr. James Watson, M. Inst. C. E., to test the suitability of steel pipes for conveying water under high pressure. He received from Messrs. Duncan Brothers, London, four pipes, 12 inches diameter, and the following is from his report:

"The pipes are made from plates of mild steel, manufactured by the Steel Company of Scotland. The plates forming the body of the pipes have a tensile strength of 30 tons per square inch, and those forming the sockets and spigots 26 tons per square inch. The pipes are in lengths of 10 feet 1¾ inches, and ⅛ inch thick, made of two plates, coated outside and inside with black varnish, and weigh 18¼ pounds per foot, or 1 cwt. 2 qr. 17 pounds per length. The body plates and junctions with sockets and spigots are lap jointed and riveted with mild steel rivets, the sockets and spigots being welded and turned on a shaping machine to the usual forms. Three lengths were tested, but only one of the four pipes sent to Dundee was operated on. The Dundee length, when filled with water and subjected to less than 100 feet of pressure, leaked at the riveted joints. The pipe was consequently removed and calked on the ground, after which it was again put under pressure up to 700 feet, when the joint leakage was still observable, but trifling in extent or quantity, and might be more fairly described as weeping at three or four parts of the longitudinal seam.

This pipe was subjected to a net compressive strain of 40½ tons upon the end of the socket, or equal to 8½ tons per square inch of sectional area, without starting any of the rivets, but with the result of doubling back the steel socket. The socket so altered in shape was found to be without fracture of any kind. The second pipe tested was sent direct from the maker's works, and was uncoated, but in other respects similar to No. 1, and its behavior in the proving machine was not, so far as the tests were carried out, quite up to No. 1. It is, however, only right to observe that the pipe was hurriedly put together during the night previous to the day on which it was tested. The third pipe was also 12 inches diameter, ½ inch thick, 8 feet 7 inches long, made of one steel plate, having a double riveted longitudinal lap joint, 1⅜ inches wide, riveted together by ¼ inch rivets at 1⅛ inch pitch, and had angle iron flanges fitted at the ends, each flange being 2½ inches by 2½ inches by ¼ inch. This pipe was subjected to a pressure of 760 pounds per square inch, or 1,775 feet head, when a portion of the calking yielded, and a slight leaking took place at two or three of the rivets.

The intention was to destroy the pipe; but as the machine in which it was placed was not constructed for such high strains, it was thought better not to further increase the pressure. As before noted, the weight of the pipe was 18¼ pounds per foot, and by way of comparison it may be mentioned that our cast iron mains, 12 inches diameter, ⅝ inch thick—tested to proof pressure of 600 feet, or a little over one-third of the pressure applied to the steel pipe—weigh 88 pounds per foot, or about four and three-quarter times heavier than those made of steel. For works such as we require in crossing the Tay Bridge, where the railway traffic sets up considerable oscillation and vibration, or in crossing some parts of Strathmore—say Meigle Moss, where cast iron, to be safe, should be laid on an artificial bed of stone or timber—steel has many obvious advantages over cast iron.

But having said this much, two questions still remain, the first and less important being the length of time and the character of labor and tools necessary to repair any accident to the body or riveted joints of the pipes *in situ;* and the second and all-important, Will steel withstand the action of soft water and equal or approach the durability or working life of cast iron? Practical experience and time can alone furnish the answer to these questions. That malleable iron cannot be safely or profitably used for such a purpose we know from the experience of actual work. In order so far to anticipate the solution of this question, laboratory experiments have been made by a number of eminent chemists, and very careful observations were made last month in London by Dr. Dupre on the action of samples of Monikie and Lintrathen waters on four samples of metal, viz., cast iron, wrought iron, and two samples of steel; and the conclusion at which he arrived was that the loss on cast iron if called 1, the loss on steel was 1·020 in the first plate and 1·098 in the second—that steel would lose in about ten years as much as cast iron would in eleven years.

If this be so, and assuming Dr. Dupre's tests to fairly indicate what would obtain in actual work, then it seems to me that, in the event of your deciding to lay down seven and a half miles of pipes through Strathmore, it might be of advantage—although a departure from the existing practice of this country—to lay down half a mile of this length with pipes made of steel, and also to lay down on the Tay Bridge four or five hundred yards of the two miles required for that work. Twelve or fifteen years hence—probably sooner—the Lintrathen main, twenty miles in length, will require a duplication throughout, and the experience of the working of a short section of steel pipes, if laid now, would enable the commissioners of that time to satisfactorily ascertain the advantage or disadvantage attaching to steel for water works purposes."

### Afloat in a Crater.

Captain C. E. Dutton, of the U. S. Geological Survey, has been recently engaged in making a study of Crater Lake, in Oregon, and the latest advices received from him show that he has discovered probably the deepest body of fresh water in the country. Leaving Ashland, Oregon, on the 7th of July, his party, escorted by ten soldiers, provided through the courtesy of the general commanding the military department of the Columbia, reached the brink of the wall of the lake on the 13th, having brought with them boats so mounted on the running gear of wagons as to bear transportation over a hundred miles of mountain road without injury. The boats bore the transportation without strain or damage, and preparations were at once begun for lowering them 900 feet to the water. The steepness of the wall was very great, being at the place selected about 41 degrees or 42 degrees, and the descent partly over talus, above covered with snow, and rocky, broken ledges lower down. The boats entered the water quite unharmed. The process of sheathing them, rigging the tackle, and lowering them occupied four days. A couple of days were occupied in making journeys around the walls of the lake by boat—the only possible way—and in examining the rocks and structures of the wall in its various parts. Next followed a series of soundings. The depth of the lake considerably exceeded the captain's anticipations, though the absence of anything like a talus near the water line already indicated deep water around the entire shore. The depths range from 853 feet to 1,996 feet, so far as the soundings show, and it is quite possible and probable that depths both greater and shallower may be found. The average depth is about 1,490 feet. The descent from the water's edge is precipitous; at 400 or 500 yards from shore, depths of 1,500 to 1,800 feet are found all around the margin. The greatest depths will probably exceed 2,000 feet, for it is not probable that the lowest point has been touched. The soundings already made indicate it as being the deepest body of fresh water in the country.—*Science.*

### The Hell Gate Light to be Stopped.

Acting Secretary Fairchild has given orders for the extinguishment of the electric light in the tower at Hell Gate, New York harbor, from and after December 1 next. This action was based on the recommendation of the Lighthouse Board, and because of constant complaints from mariners that the dazzling character of the light made it a detriment, instead of an aid, to navigation.

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## ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Milton W. Coddington, of Rutherford, N. J. It is designed as an automatic coupler, in which the star cam is used for retaining the connecting link, the invention covering a novel construction, arrangement, and combination of parts.

A car coupling has been patented by Mr. George J. Ferguson, of Greenville, Tex. This invention covers a novel construction and arrangement of parts of a continuous drawbar, the bars extending to the middle of the car, and forming connections between the ends of the car, with other novel features in automatic car couplings.

A gate valve has been patented by Mr. William Jackson, of Allegheny City, Pa. Combined with a valve casing having guiding recesses, with a screw stem, is a two-part gate, consisting of two rings, having on their inner edges a double screw-thread-like curve, each having a lug moving in a recess of the valve casing, with other novel features, whereby, when closing, the valve seats itself automatically and firmly.

A lubricator has been patented by Messrs. Thomas Davis and Henry H. McDonough, of East Boston, Mass. It is of that class used to supply oil to the valves of locomotive or hoisting engines, where the live steam is often shut off from the cylinder, and provides a simple and inexpensive device whereby oil will be fed to the engine valve by exhaust action only.

An automatic continuous rail frog and switch has been patented by Mr. Casper Buhrer, of Cambridge City, Ind. A curved wing rail is elevated above the main track, pivoted at one end at the side of the track, and connected to a crank rod operated by one or more pressure bars pivoted to the side of a switch or siding rail, so a train will force the bars down and operate the crank rod, to throw the wing rail in position for the siding or switch.

A compound locomotive engine has been patented by Messrs. William B. and John A. Johnson, of Wigan, Lancaster Co., Eng. It has two cylinders on each side, the high pressure cylinder being fed directly from the boiler, and each high pressure cylinder exhausting into two steam chests made common to the two low pressure cylinders, which are connected by a cross pipe, the pistons both being on one rod, the valves being operated by a link motion with a link to each cylinder.

## AGRICULTURAL INVENTIONS.

A hay carrier has been patented by Mr. Edwin Woodward, of Stryker, O. The invention consists of a novel construction and combination of various parts of a transferring mechanism for hay carrier guide pulleys, for transferring hay from one end of the barn to the other, so that it can be done easily and quickly and without any climbing.

A corn harvesting and husking machine has been patented by Mr. John A. Hilbert, of Carroll, Iowa. Combined with a stalk cutting mechanism and an open endless stalk carrier is a supplemental or ear cutting mechanism for severing the ears from the stalks, with other novel features, the machine being designed to cut the stalks, separate the ears from the stalks and husks, and deliver the husked ears into wagons drawn at the sides of the machine.

A corn planter has been patented by Mr. Ernest H. Korsmeyer, of Evansville, Ind. In connection with a suitable frame and various novel features of construction, the seed dropping tube is combined with a cutter having a forked rear edge, whereby a channel is opened in the ground and the seed conducted thereto, the machine being susceptible of adjustment, so that the cutter will enter the ground to any desired depth, while it can be raised and secured above the ground for convenience in passing obstructions, etc.

A seed planter has likewise been patented by the same inventor, with various novel features of construction and arrangement of parts, in which, by properly handling the valves, the hills may be made at any desired distance apart, thus adapting the machine both for drilling and planting.

## MISCELLANEOUS INVENTIONS.

A funnel stand has been patented by Messrs. James and John C. Colburn, of Altoona, Pa. It is to be placed upon the counters in groceries, to receive and hold the funnels, and is so made that it does not have to be held while pouring the substance to be done up from the scale pan through the funnel into a paper bag or other package.

A hub attaching device has been patented by Mr. Walter A. Clark, of Chicago, Ill. It is applicable to the ordinary form of vehicle wheel axle, with but slight changes to adapt the axles and hubs to the improved attachment, the object being to prevent the accidental displacement of the wheels, and supply means whereby the retaining nuts upon the ends of the axles may be removed when desired, while the axle will be thoroughly protected from sand and grit.

A pendant stem for watches has been patented by Mr. Fredrick W. Schimmel, of Murray, Idaho Ter. Combined with an internally threaded pendant is an externally threaded collar, placed movably on the stem, and fitted to the threaded portion of the pendant, the collar being notched on opposite sides, and the stem being provided with pins for engaging the notches, the device being durable and intended to prevent dust from entering the movements.

A camera obscura has been patented by Messrs. Frank Sharpe and Harry E. Blake, of North Adams, Mass. It is designed for the use of artists in taking from small pictures correct outlines enlarged to any desired extent, or for taking enlarged outlines of flowers, leaves, fruit, etc., and the apparatus has a mirror, a focusing slide, a lens, a dark chamber, an adjustable swiveling lamp, and a curtain, with various novel details of arrangement and combination of parts.

## NEW BOOKS AND PUBLICATIONS.

TABLES AND FORMULÆ FOR RAILROAD ENGINEERS. By B. H. Hardaway. New York: E. & F. N. Spon.

This is a convenient pocket-book, furnished in conjunction with a transitman's blank note-book, intended to present formulæ and tables convenient for the civil engineer for railroad or field work, embracing also tables and examples relative to running transition curves.

ACCIDENTS IN MINES. By Arthur Robert Sawyer. New York: John Wiley & Sons.

This book relates especially to accidents arising from falls of roofs and sides in mines of the North Staffordshire (England) coal field, and gives detailed sections of the workable seams and an account of the system of timbering. The sections and plans have been reproduced with exactness to show how some of these accidents have been caused, and to point to different precautions in mines generally for their prevention. The illustrations are notably numerous and valuable.

## Business and Personal.

*The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*


The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

Wanted—To sell patent for cigar bundling machine, issued Sept. 7, 1886. Address F. Theo. Karsch, 706 Spring Garden St., Philadelphia, Pa.

Concrete patents for sale. E. L. Ransome, S. F., Cal.

For Sale—Patent No. 315,652, cock for house service and street washer connections. By turning the cock the water from the street main may be opened to house alone, or to both house and street washer, or may be entirely shut off. F. M. Fogg, 12 Water St., Brooklyn, N. Y.

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Woodworking Machinery of all kinds. The Bentel & Margedant Co., 116 Fourth St., Hamilton, O.

*A Catechism on the Locomotive.* By M. N. Forney. With 19 plates, 227 engravings, and 600 pages. $2.50. Sent on receipt of the price by Munn & Co., 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue now ready.

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Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Planing and Matching Machines. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Beach's Improved Pat. Thread Cutting and Diamond Point Lathe Tool. Billings & Spencer Co., Hartford, Ct.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. D. Frisbie & Co., N.Y. city.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

Barrel, Keg, Hogshead, StaveMach'y. See adv. p. 366.

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## Notes & Queries

### HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
**References** to former articles or answers should give date of paper and page or number of question.
**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.
**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.
**Books** referred to promptly supplied on receipt of price.
**Minerals** sent for examination should be distinctly marked or labeled.

(1) G. W. T. asks for a proper formula for making solid blue ink, or marking paste, to be used with a brush for stenciling. A. Try the following: Shellac 2 ounces, borax 2 ounces, water 25 ounces, gum arabic 2 ounces, ultramarine sufficient. Boil the borax and shellac in some of the water till they are dissolved, and withdraw from the fire. When the solution has become cold, add the rest of the 25 ounces of water, and the ultramarine. When it is to be used with a stencil, it must be made thicker than when it is to be applied with a marking brush.

(2) H. S. McC. asks for a receipt for refining lard. A. The process for purifying lard commercially requires a complicated apparatus. In an ordinary way lard may be purified by heating the melted fat with some sulphuric acid of 1·3 to 1·45 specific gravity, when the fat will separate itself in a pure condition from the impurities and membranous substances.

(3) J. W. P. asks how to polish amber mouth pieces of cigar holders, which have been scraped with a knife blade. A. By rubbing with whiting and water, and finally with a little olive oil well rubbed with a piece of flannel.

(4) F. J. K. asks for a short receipt for reducing gold of different degrees of fineness to a mass of a single carat throughout. A. Melt the gold in a covered crucible and stir or shake well.

(5) A. T. P. asks: 1. What is the best, or a good, cement for tableting writing paper? A. Try either of the following: *a.* The highest grade transparent glue is soaked 10 minutes in water and melted to a thin solution, and 9 lb. of glycerine added to every 50 lb. of glue. It is colored with alcoholic solution of aniline or cochineal. *b.* Common glue, with about 5 per cent glycerine. *c.* Crude gutta percha dissolved in carbon disulphide to the consistence of mucilage. The materials used in making this glue or cement for pads vary in grade, so that some experiment is necessary to make a good preparation. 2. Is there any chemical that will keep clothes from turning yellow when boiled with sal soda? A. We know of nothing that would not also be injurious to the fabric. We would recommend bleaching by exposure to sunlight in preference to the use of any chemical.

(6) W. J. F. asks for a receipt for cleaning black silk. A. See the "Removal of Stains and Grease Spots," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(7) H. M. G. asks: 1. Where can I get asphaltum solution, spoken of in the article "Photo-Zincotypes and Other Photographic Printing Methods for the Printing Press," published in the SCIENTIFIC AMERICAN of July 24, 1886, page 49? What am I to ask for? A. From the receipt as given on page 49, any druggist should be competent to make the preparation, otherwise apply to E. & H. T. Anthony, New York, giving reference, and they will supply it. 2. Have you ever published an article in the SUPPLEMENT, with working drawings, descriptive of a large dynamo? A. We have not as yet published any article containing working drawings for a large dynamo.

(8) J. G. P. asks for a recipe by which he can cause India ink to remain liquid, keep from spoiling, and be waterproof, in a word, a recipe for waterproof drawing ink. A. We know of no means by which, if any material be added to India ink, it can be made waterproof, but would suggest that the drawing itself be covered with a thin coating of the following: Dissolve 30 to 40 parts of dammar in 180 parts of acetone, and then mix 40 parts of this solution with 20 parts of thickly fluid collodion.

(9) F. K. asks what coloring matter to mix with silicate of soda in order to obtain a white colored paint? A. Try oxide of zinc. It will mix readily with silicate of soda.

(10) E. S. A. S. asks for a receipt for making hair oil that is not injurious to the hair. A. Try the following: Castor oil ½ pint, 95 per cent alcohol ½ pint, tincture cantharides ½ ounce, oil of bergamot 2 drachms. Color a pale pink with alkanet root.

(11) E. W. M. writes: I have made a very good ink as follows: Water ½ pint, extract of logwood 60 grains, yellow chromate of potash 5 grains, but after standing a few days it gets ropy, so that I cannot use it. Can you tell me how to overcome the difficulty? A. It is one of the peculiarities of the inks made with chromate of potash. You will find numerous other receipts in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, of which the aniline black ink is probably best suited to your wants.

(12) M. E. W. asks: 1. What kind of oil is best for oiling paper? Oil that is least liable to heat, and which will dry quickest? A. Use a boiled linseed oil that is reboiled with litharge, lead acetate, zinc sulphate, and burnt umber, one ounce of each per gallon. 2. What oil do makers of those old fashioned, yellow colored oil coats use, such as boatmen and cartmen used to wear? A. Boiled linseed oil.

(13) E. O. E asks the best method of repolishing artificial eyes after being roughened by use. A. The glass can be made smooth by the use of moist emery, after which it is polished with fine colcothar or rouge moistened with water, with rubbers of hat felt, finishing with a little moistened putty powder.


### TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.


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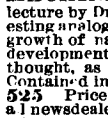
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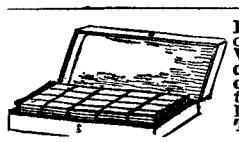
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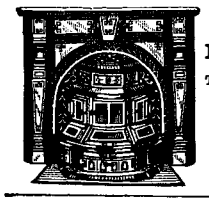

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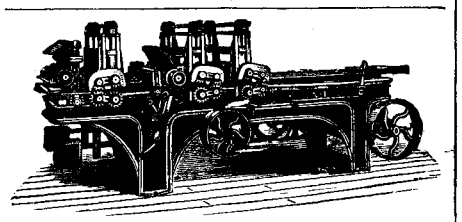

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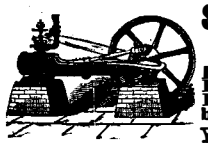

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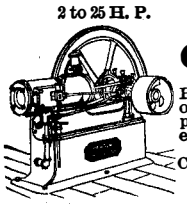

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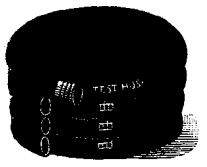

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## TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.

UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,310 tons of steel gun-forgings, of which about 328 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 912 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

| | |
|---|---|
| 6-inch | 3¼ tons. |
| 8 " | 5 " |
| 10 " | 9¼ " |
| 10½ " | 9¾ " |
| 12 " | 12¾ " |

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4¼ feet by 6 inches thick.
There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.
*First.* Gun Forgings.
*Second.* Armor-plate.

And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY,
*Secretary of the Navy.*

NOTICE.
NAVY DEPARTMENT,
WASHINGTON, *November* 6, 1886.

The time fixed by the foregoing advertisement, dated August 21, 1886, for receiving proposals for steel gun-forgings and armor-plates, viz.: December 10, 1886, is extended to 12 o'clock noon, March 15, 1887, at which hour the opening of the bids will take place.

WILLIAM C. WHITNEY,
*Secretary of the Navy.*


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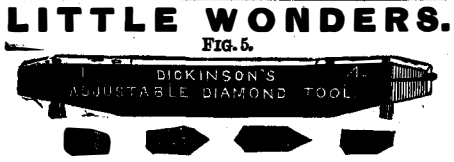
**LITTLE WONDERS.**

FIG. 5.

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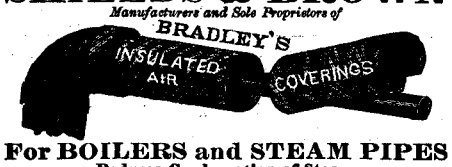


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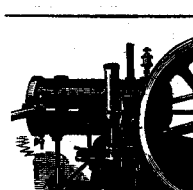


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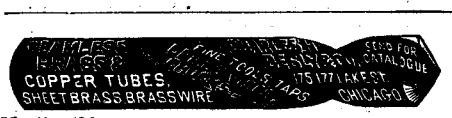


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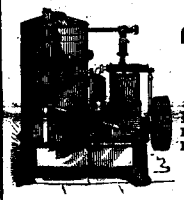

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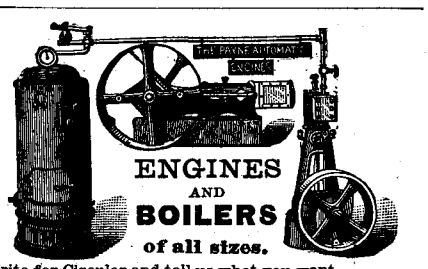


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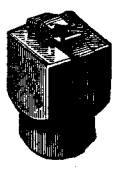

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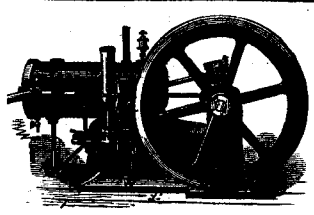

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